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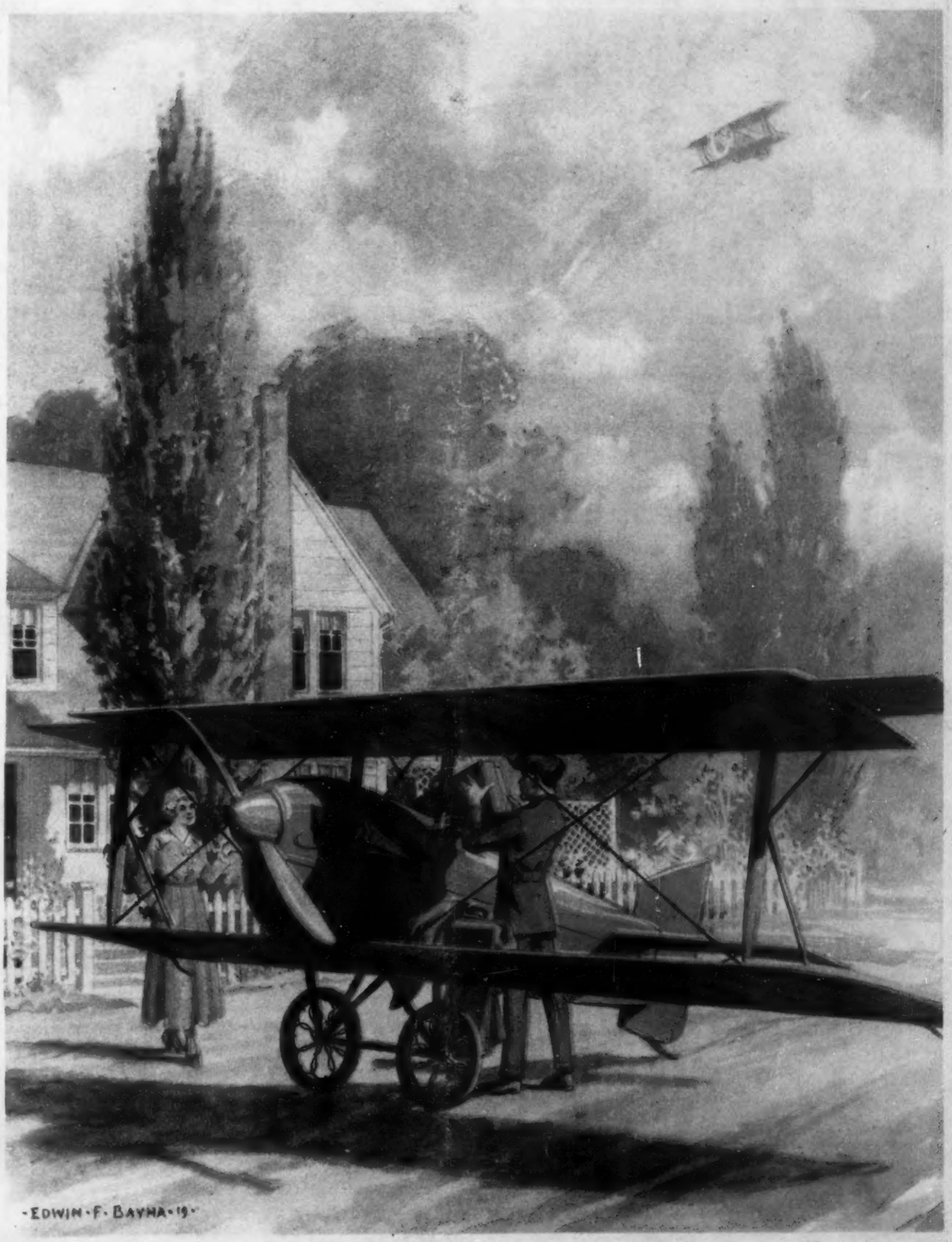
# SCIENTIFIC AMERICAN

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.




A SINGLE-SEATER AIRPLANE FOR "EVERYMAN'S" USE [See page 203]

1919

Vol. CXX. No. 9
March 1, 1919

Published Weekly by
Scientific American Publishing Co.

Price 10 Cents
$5.00 a Year

# WHAT MAKES *VALUE* *in* A MOTOR TRUCK

A TRUCK yields so much performance for so much money—price plus operating cost. What it can do, how long it can do it, how dependably, at what cost, *alone* determine its value, into which enter five factors to be carefully considered by every purchaser. These are:

### Record and Performance

WHAT a truck can do is measured by what it has done, in work accomplished and length of service. Where comparative cost records are properly kept, single unit White installations grow into fleets. In mixed fleets, White equipment is uniformly selected for the hardest task.

### The Maker

EVERY truck needs a sponsor, a maker whose name is a guarantee of honest, efficient manufacture, whose policies and resources assure that he will be here to stand back of his product *permanently*. The importance of this is apparent when you consider how few makers survive in any line of manufacture.

The White Company is financially sound. It has been building highest quality motor vehicles for eighteen years, and holds a manufacturing position second to none.

### The Factory

THE White factory is one of the largest in the industry and is so modernly equipped that a very large volume of output is obtained per unit of labor. Thus the purchaser receives value fully commensurate with his investment.

### Truck Experience

THE White Company sells not merely trucks. It sells efficient transportation. It *knows how* to install the kind and size of equipment for a given task, can adjust the truck installation to keep step with the business. It has knowledge gained by years of experience with many thousands of trucks in all lines of trade—*an asset of the greatest importance to the purchaser.*

### Service Facilities

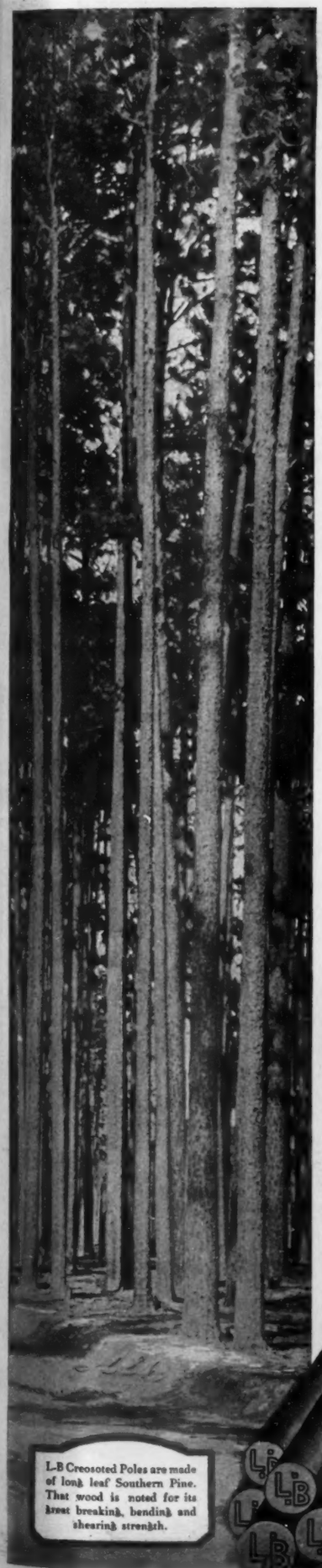
TO get maximum earnings out of a truck, it must be *kept going*, and this can be assured only by resourceful and convenient service to the owner.

The White Company has covered the country with facilities for quick and complete service—plants, spare parts and field organization. It required years to build up. No new manufacturer can do this; no small manufacturer can afford it.

The purchaser of White Trucks secures motor transportation at the lowest cost, expertly installed and permanently protected.

**THE WHITE COMPANY,**

**CLEVELAND**



L-B Creosoted Poles are made of long leaf Southern Pine. That wood is noted for its great breaking, bending and shearing strength.

# A Trade-Mark That Identifies Quality Lumber Products

THE LONG-BELL LUMBER COMPANY has a well established reputation for the uniform high quality of its lumber products. As evidence of that fact, in the short time of twenty-five years, the number of our saw mills has increased from one to thirteen, and we have become the largest manufacturers of Southern Pine in the United States. Vast virgin forests, complete, modern mills, milling methods which are unsurpassed, and the infinite care given to every detail of our business make this trade-mark—

## LONG-BELL

THE MARK ON QUALITY LUMBER

That mark is now branded on our lumber products. It identifies quality.

LONG-BELL Air Seasoned, Creosoted long leaf Southern Pine Poles, one of our well known products, are decay proof. They will give satisfactory service for upwards of 50 years, for, the LONG-BELL hydraulic-pressure-vacuum process of creosoting thoroughly impregnates the entire sap wood. LONG-BELL Creosoted Southern Pine Poles possess great strength, resist ordinary grass and brush fires and are straight and attractive. They are branded on one end with the L-B mark.

Officials responsible for continuous efficiency will find that LONG-BELL Creosoted Poles assure good service and will prove to be a sound investment.

To be sure of quality, ask your dealer for lumber products bearing the LONG-BELL trade-mark

**The Long-Bell Lumber Company**

R. A. LONG BLDG. KANSAS CITY, MO.

*Manufacturer of* Southern Pine, Hardwood, Oak Flooring, and Creosoted Lumber, Ties, Posts, Poles, Piling and Wood Blocks

These interesting books: "Poles That Resist Decay" and "The Post Everlasting" sent free on request.

L-B Creosoted Poles in use. They reduce line work to a minimum, withstand wind and sleet storms, require no replacements or repairs.

# PACKARD PRICE INSURANCE

*In fairness and justice to all purchasers of Packard transportation units, whether Packard Trucks or the famous Twin Six Passenger Cars, we wish to make plain our position regarding prices for the coming year*

THE Packard policy is nothing short of absolute insurance of your investment at present price quotations.

If at any period during 1919, by reason of lower costs of material and labor or for any other reason this Company finds it possible to make a price reduction, this reduction will not only be made but made retroactive and we will refund to every previous 1919 purchaser the full amount of the difference between the price he paid and the new price.

If, on the other hand, production costs should increase and a higher price become necessary, the present purchaser has the advantage of his investment as the new price will apply only to those whose orders are received *after* the change is announced.

As we stated some weeks ago, Packard prices are carefully and accurately based on the cost of material and labor. There was no artificial inflation during the war and costs have not decreased since we last manufactured for private consumption, consequently there is no leeway for a price reduction now.

If a reduction becomes possible, every present buyer sees his investment protected and insured.

* * *

This policy, while unique in the automobile world today, is consistent with Packard policy in the past, and seems to us the most fair and straightforward way of meeting present conditions.

*Were we to give a guarantee that present prices would be maintained, it would mean a one-sided bargain in favor of the manufacturer, as it would prevent us giving the buyer a reduction, should material and labor costs justify a reduction.*

The Packard Company makes a greater percentage of all the parts that enter into its car than is made by any other fine automobile concern in America. It does this because it cannot buy and assemble parts that are up to the Packard standard of service and quality.

Skilled labor of necessity enters very largely into the production of so beautiful, so simple and so proficient a mechanism.

The net result is that the upkeep of a Packard Twin Six is less than that of compromise cars at half or two-thirds the Packard price.

To the man who can afford the first cost, a Packard delivers utility value for every dollar of his investment, greater economy, less depreciation and it does not ask him or his family to compromise in the service, the comfort, the safety of their motoring.

From present indications there will not be enough of either Packard cars or trucks to meet the demand this year.

Trucks are ready for immediate delivery. Your order for a Packard Twin Six passenger car of any model should be registered with your Packard dealer at once to insure late spring delivery.

*"Ask the Man Who Owns One"*

## PACKARD MOTOR CAR COMPANY, *Detroit*

**Transportation Specialists—for freight or passenger service by high road or air route—Trucks, Passenger Cars and Airplanes**

SEVENTY-FIFTH YEAR

# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXX. NUMBER 9 | NEW YORK. MARCH 1, 1919 | [10 CENTS A COPY $5.00 A YEAR

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**The proposed 3-year naval program will cost sixteen times as much as the total cost of these famous New York buildings—Woolworth, Adams Express, Singer, Metropolitan Life, Equitable, and the Pennsylvania Station** [See page 204]

# SCIENTIFIC AMERICAN

**Published by Scientific American Publishing Co.**
**Founded 1845**
**New York, Saturday, March 1, 1919**
**Munn & Co., 233 Broadway, New York**

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
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*The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.*

*The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.*

## Derelict Mines—A Peace Peril

ONE of the regulations of the Hague Convention directs that all mines and torpedoes shall be so adjusted that they can never become a permanent menace to navigation. Torpedoes must carry an automatic device of such a character that, if the torpedo misses the mark, the firing mechanism will become inoperative; and mines must be so constructed that if they break loose from their moorings and float to the surface, their firing mechanism will cease to operate. These obligations form part of a series of rules and regulations which are designed to protect noncombatant ships, both during war time and in the peace that follows a war. There is abundant evidence that the enemy failed to live up to these humane stipulations —a fact which is continually being brought to public attention by the loss of merchant ships, through contact with mines, in almost every quarter of the navigable seas.

One of the stipulations of the armistice called for the full disclosure by Germany of the plans, charts, etc., showing the location and extent of the areas which she had mined during the war; and in the intervening months since the armistice, allied mine-sweepers have been engaged in removing these obstructions. In view of the disorganization of their navy during the latter part of the war, it is doubtful if the German Admiralty accurately charted the mined areas, and this must be particularly true of the work done by the German submarine mine-planters, which probably had a roving commission to drop their eggs wherever the individual commander had opportunity for undisturbed operation.

But even if the German admiralty has accurate charts of its own mine-fields, the complete removal of these would not mean that the seas have been rid of this deadly peril. Swift currents and heavy seas frequently cause the mines to break adrift from their moorings, and when this happens each mine becomes a floating menace which is more deadly to navigation than any water-logged lumber schooner or other derelict of the sea. The allied navies followed strictly the rules of the Hague Convention and when allied mines broke adrift, or torpedoes went astray, they became, or were designed to become, innocuous. The ruthless methods of sea warfare followed by the enemy included a total neglect of this precaution, with the result that heaven alone knows how many mines are floating on the surface of the sea that require only a touch from a passing ship to detonate them.

For these reasons we think that for some time to come shipping should continue to use the protective measures which proved so effective during the war, particularly when they are passing through waters such as those lying off our own coast and those of Europe where the enemy mine-layers were most active during the war. Many merchant skippers are alive to the danger and are acting accordingly. The captain of a freight ship informs us that, once clear of the harbor entrance of an American port, he throws overboard his paravanes and does not take them in until he is well out to sea; and that, on approaching his European port of destination, he makes a point of dropping them overboard again. How long the peril will continue cannot even be conjectured; but it will be remembered that over a year after the close of the Russo-Japanese war, a merchant ship was sunk in the eastern waters of the Pacific by a mine which had broken adrift during or subsequently to the naval operations of the war. For a long time to come it will be the duty of the watch to keep a sharp lookout for this deadly peril of the sea.

## The Hudson River Tunnel

IT is doubtful if there is a problem of transportation anywhere in the United States which calls for a speedy solution so loudly as that which concerns the city and port of New York. To say that present facilities, both for passengers and freight, are inadequate is to state a fact which is perfectly well-known to every New Yorker, from railway president down to the humblest strap-hanger.

It is as true as it is paradoxical that the very topographical features which make New York one of the finest ports in the world, at the same time render it one of the most difficult to operate; for although the Hudson River is a magnificent fairway for shipping, its breadth of 3,000 feet has proved a serious obstacle to the working out of a well-coördinated and economical system for the distribution of passengers and freight, and particularly of the latter.

Not only is Manhattan the very heart of financial, commercial, theater-going and pleasure-seeking New York, but the indications are that it will ever remain such; and the problem of the distribution of freight and passenger traffic will always depend upon the question of overcoming the great natural obstacle which separates Manhattan from the mainland.

Twenty to twenty-five years ago it was believed that the solution lay in the construction of one or more bridges across the great river; but just on the eve of the active construction of a bridge, the development of electric traction reached a stage which made it possible to operate passenger trains beneath the Hudson River without fear of killing off the travelers with that most deadly poison, carbon monoxide gas. Thereupon, we saw the construction of the two Pennsylvania tubes and the four tubes of the Hudson tunnel system, all electrically operated.

But let it be carefully noted that the engineering world refused to commit itself to the construction of these tubes until the electric locomotive was forthcoming, for it was well understood that any system of traction which involved the combustion of fuel and the expulsion into the tunnel of the poisonous products of combustion, was ruled out of the case on the ground of human health and safety. It is needless to say that electric traction through these tunnels has been a great success and that there has been no difficulty in maintaining the purity of the air.

It is now proposed to build a great double-deck tunnel beneath the Hudson and use it for motor truck and automobile traffic. This would be an altogether commendable enterprise if its promoters were possessed of reliable data, based on actual working conditions, which showed that it was possible to allow a closely-spaced stream of automobile and motor truck traffic to proceed continuously through a tunnel several thousand feet in length; but no such data exist. The danger of asphyxiation of passengers, truck drivers, chauffeurs, etc., arises from the fact that perfect combustion can never be obtained in the cylinders of a motor, and that there is consequently a certain percentage of that deadly poison, carbon monoxide, exhausted into the air. Experiments made by Clerk showed that this poison is present in a ratio ranging from 2.4 to 6.9 per cent of the total volume of the exhaust of a motor car, and the Royal Automobile Club, in a test of 12 cars, obtained four results below two per cent and eight above that figure, while other observers report as high as 15 per cent of carbon monoxide.

The peril of this poison lies in the fact that it is colorless, odorless, and tasteless, and that, except by chemical analysis, its presence can be detected only by the symptoms of poisoning in the patient. The sponsors of the tunnel believe that it can be properly ventilated by artificial means; but one of our most expert authorities on ventilation has estimated that to ventilate the 5,500 feet of tunnel between the main shafts would call for a 32,000 horse-power plant—that is to say, to keep the percentage of carbon monoxide down to the point of safety would require such a rapid continuous replacement of the air, that a ventilating system of that great horsepower would be necessary to do this work with a proper factor of safety.

Therefore, we urge upon the authorities the necessity of making, in the interests of public safety, a most thorough examination of this question of ventilation before the necessary sanctions for operation are given. The tunnel should be built, but with the understanding that it shall be used only for electric and horse-drawn traffic, for such is the growth of Greater New York and Jersey City that any and every means of rail and vehicular transportation between Manhattan Island and the mainland will be used to its full capacity, almost from the very day on which it is put in service.

## The Doubtful Factors in the Problem of Transatlantic Flight

THAT a flight across the Atlantic Ocean will be made in the immediate future is almost certain. It is, in fact, altogether remarkable that isolated feats of this kind have not been achieved before now. The establishment of anything like a regular aerial transport service over the Atlantic is, however, quite another matter. It would be unsafe to predict how soon, and under what conditions, this will be realized.

The monumental report of the Civil Aerial Transport Committee, recently published in England, embodies some discordant ideas on this interesting question. Few persons have given more study to the problem of transatlantic flight than Commander Porte, whose preparations to undertake such a journey in the summer of 1914 were terminated by the outbreak of the war. This authority, as quoted in the report just mentioned, believes that the direct route between Ireland and Newfoundland is at present out of the question, and that for many years to come the only practicable route will be by way of the Azores. Commander Porte also considers Newfoundland an unfavorable terminus for the westward journey, on account of the obstacle opposed to a safe landing by the notorious fogs of that region. He prefers a landing ground on Long Island, though its distance from San Miguel (Azores) is about 2,250 nautical miles, as compared with 1,346 miles from San Miguel to Newfoundland.

The elements of uncertainty in transatlantic flying are almost wholly meteorological. The proposed Azores route offers the advantage of the trade winds for the westward journey. Whether, and to what extent, the counter-trades, which blow above the trades and in the opposite direction, could be utilized for the return journey to Europe is still doubtful, because we lack precise information about these winds; particularly as to the level at which they blow. In higher latitudes westerly winds prevail, but they are much interrupted by cyclonic storms. Here, again, the question arises whether it would be possible to fly high enough to secure comparative immunity from adverse currents.

That the coasts of Newfoundland are habitually shrouded in fog seems to be taken for granted in all speculations about Atlantic flight. The British report, however, contains two communications from authoritative sources which emphatically discredit this idea. Sir E. Morris, who has lived and yachted along the Newfoundland coast for years, declares that fog prevails there only with winds from a quarter between northeast and southwest, while the prevailing winds are from west and northwest. He has seen a whole season from April to November pass without rain or fog. He also emphasizes the fact, borne out by a letter from another resident of Newfoundland, that the fogs of that region are generally very shallow. This, we recall, was likewise the experience of the U. S. Coast Guard observers.

The moral of all this seems to be that a meteorological and aerological survey of the North Atlantic Ocean and the adjacent coasts should be undertaken as soon as possible, with special reference to the needs of aeronautics. That air lanes across the Atlantic are destined to become of great economic importance hardly admits of doubt. The study of surface meteorological conditions over the ocean, the corner-stone of which was laid by Maury in the middle of the last century, has yielded results of indispensable value to mariners. Maury depended for his data upon the mariners themselves; but the Maurys of the air should better this plan and *anticipate* the demands of aerial navigators, by a systematic campaign of scientific expeditions *ad hoc*. This method would obviate heavy losses in both life and money in the early stages of trans-ocean flight.

## Electricity

**Automatic Fire Extinguishers for Transformers.**—In conjunction with the Salzkotten Works for explosion-proof containers, the firm of Siemens & Halske of Germany has developed an automatic fire-extinguishing equipment for use with trasformer or oil-switch chambers. A thermally sensitive device in the chamber to be protected closes a relay circuit when the temperature in the chamber exceeds a predetermined limit. The effect of this is that a tank of sulfuric acid is emptied into a potassium carbonate solution and the $CO_2$ formed is carried by a pipe line to the chamber where fire has broken out. The chamber is filled quickly with the gas and the fire is stifled. At the same time one or more alarm bells are rung, the ventilating chimney in the roof and the oil outlet in the floor of the chamber are closed, and valves in the $CO_2$ pipes leading to the chamber affected are opened. Description of an actual installation is given with dimensions of the apparatus in a recent issue of *Science Abstracts*.

**Underground Wireless.**—Speaking recently of his work for the Navy, Prof. James R. Rogers, the inventor of a wireless system for underground and submarine transmission, stated: "Six or seven years ago, I began experiments with the transmission of electric impulses by the ground. They were renewed during the war with the audion bulb, which renders the receiving apparatus more sensitive. I first established contact with nearby points and before long received with perfect distinctness impulses sent from Europe. I placed my antennae in trenches radiating from a center and pointing by the compass toward the distant station from which I wished to receive. I demonstrated to the Navy Department that eight operators may receive at once from eight separate wires. My system was installed at New Orleans, the Great Lakes station, and Belmar, N. Y., and is now used at the principal wireless stations in the United States. I have found the best results with my wires buried six feet below the surface in damp ground. Some of my experiments were conducted in water 25 to 50 feet deep.

**Radio Telegraphy in the British Air Service.**—The new air service for passengers, mails and parcels delivery will begin, it is stated, in the United Kingdom and the continent of Europe. Every airplane will be supplied with a combined wireless and telegraph installation and an efficient operator, adopting the same system as is in force with regard to ships. As every airplane will doubtless have either a name or a distinguishing number, it will be possible to send telegrams from any part of the world, or from any ship on the sea, to the airplane. It is intended, continues *The Electrician* that this organization will be ready by the time peace is signed, and the relaxation of restrictions will allow the free flight of airplanes. Arrangements have recently been made for the erection of wireless stations in the extreme parts of China, one on the frontiers of Cashmere and the other on the Chinese side of Siberia. For this purpose machinery will have to be conveyed right across China, and transport by air will have to be arranged, for there is neither railway nor road. The Marconi Company has arranged with Mr. Handley Page for the transport by one or more of his big machines.

**A Standard in Radiotherapeutics.**—The problem of a suitable standard of quantity for use in radiotherapeutics has received much attention, and cannot be said to have been completely solved. Most of the devices have been based on the application, as the units, of a certain fraction of the energy required to produce inflammation or redness of the skin, but this is naturally a somewhat indefinite measure, as is shown by the fact that the ratio most commonly employed, originally one-third, is now taken as one-fifth. Mr. Bordier, in a recent communication to the Académie des Sciences, proposes as an alternative a method depending on chemical dissociation, and has devised a "chromoradiometer," providing five chief scales (based on coloration) which will suffice for all clinical cases, according to *The Electrician*. The unit is defined as the quantity of X-rays capable of liberating 0.1 milligramme of iodine in a cubic centimeter of a two per cent chloroformic solution of iodoform of a thickness of 1 cm., and placed in the shadow of the radiation. This unit, it is contended, depends on precise physical processes, which is not the case in the methods previously mentioned.

## Science

**Stenches as Danger Signals in Mines.**—The U. S. Bureau of Mines announces that it has developed a novel method for giving a danger warning in mines, particularly metal mines, in which compressed air is used throughout the workings. An ill-smelling substance is injected into the compressed-air line, and within a few minutes the odor is spread through all parts of the mine. A technical paper is to be published on this subject.

**The Mineral Resources of Spitsbergen.**—According to a note in *Nature*, the accessible coalfields of Spitsbergen are estimated to have a content of at least 4,000,000,000 tons of good steam-coal, and this region is destined to become one of the chief coal-producing countries of Europe. About 100,000 tons of coal were shipped from Spitsbergen to Scandinavian countries last year. Promising samples of iron ore have been received from this archipelago, other mineral resources of which include gypsum in enormous quantities, asbestos, copper ore, oil shale and probably free oil.

**Fighting Mosquitoes with Bats in the Philippines.**—The idea of fighting mosquitoes, and incidentally providing a source of guano, by the erection of bat roosts figured widely in the press some six or seven years ago, in connection with an undertaking of this sort in Texas. It is interesting to learn that this idea has now been taken up in the Philippines, where the Bureau of Science is encouraging the building of bat roosts as an aid to the destruction of mosquitoes. The Bureau has drawn up plans and specifications for this device, which it distributes to any one who will erect a roost.

**A Sumptuous Work on Pheasants** is William Beebe's "Monograph of the Pheasants," in four volumes, the first of which has recently been published in England under the auspices of the New York Zoological Society. In order to collect material for this work the author, with the aid of funds supplied by Col. A. R. Kuser, of Bernardsville, N. J., spent 17 months in a tour of southern Asia and the East Indies, and also visited a number of museums in Europe. The monograph will constitute by far the most important source of information on the subject with which it deals. It is copiously and beautifully illustrated, but—a four-volume scientific work that sells for $250 is an anomaly that ought to be corrected!

**The Study of Industrial Fatigue,** as carried on in British munition factories during the war, led to results of great interest to both employers and employees. We are glad to learn that the British are now going to extend these investigations to industrial establishments generally, and have accordingly established an Industrial Fatigue Research Board, under the Department of Scientific and Industrial Research and the Medical Research Committee. The duties of the board, as reported in *Nature*, will be to initiate, organize and promote, by research, grants or otherwise, investigations in different industries with the view of finding the most favorable hours of labor, spells of work, rest pauses, etc. The chairman of the board is Prof. C. S. Sherrington, and headquarters have been established at 15 Great George St., Westminster, S. W. 1, London.

**New Experiment Stations of the Bureau of Mines.** Of three experiment stations lately established by the U. S. Bureau of Mines, one has been located at Bartlesville, Okla., and will devote its attention to the petroleum industry. The town of Bartlesville, through its chamber of commerce, donated the site and provided $50,000 for the erection of buildings, and it is expected that the state of Oklahoma will provide funds for coöperative investigations. A second station, which will be devoted to studies relating to ceramics, has been located at Columbus, Ohio, which is the center of important clay industries. The University of Ohio provided quarters and is furnishing half the necessary funds for the support of the station. The third new station, situated at Minneapolis, will investigate problems relating to the iron and steel industry. The first year has been devoted to the question of increasing the supply of manganese available for making steel, in view of the serious shortage of this substance. Eventually the Minneapolis station will take up the important question of beneficiating the low-grade iron ores upon which the iron industry will be obliged to depend when the rich ores now available in the Lake Superior region and elsewhere are exhausted.

## Astronomy

**More Novæ in the Andromeda Nebula.**—Two more novæ were found in the Andromeda nebula on photographic plates taken last October with the 60-inch reflector of the Mount Wilson observatory, making a total of 11 thus far discovered within the limits of the nebula. Neither of these two appears on plates taken in August, which probably records stars of the 18th photographic magnitude.

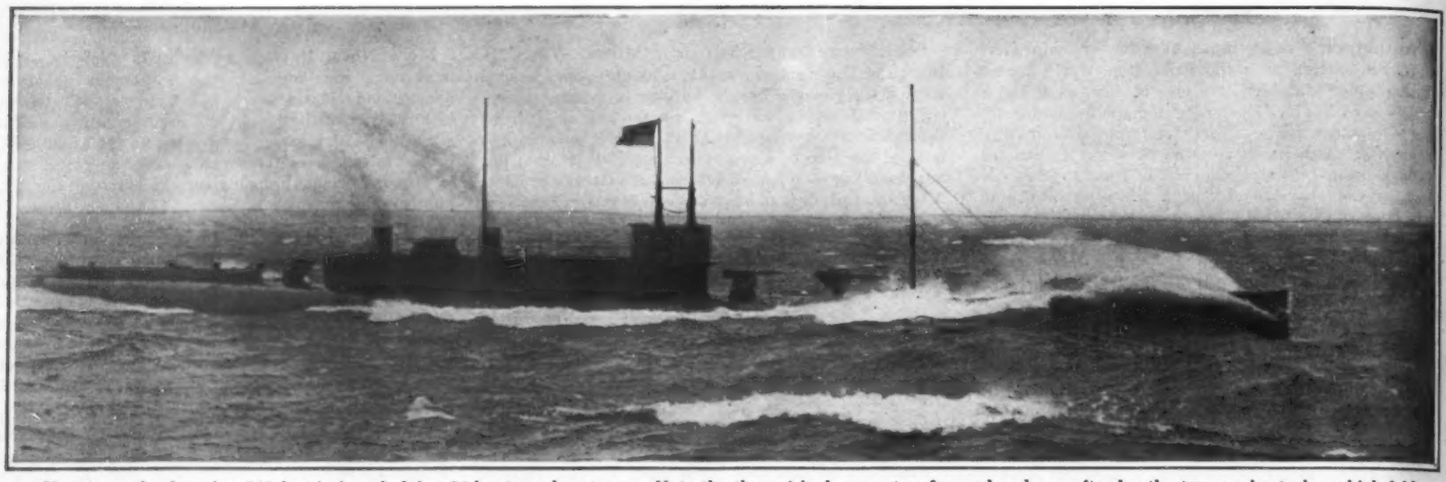
**A New Observatory in Arizona.**—In consequence of a gift of $60,000 from the late Mrs. H. S. Steward, of Tucson, as a memorial to her husband, a new astronomical observatory is about to be erected on the campus of the University of Arizona, at Tucson. The principal telescope, a 37-inch reflector, was ordered some time ago, but work on it has been delayed by the war. The observatory will be under the direction of Prof. A. E. Douglass.

**Interstellar Media and the Colors of Stars.**—Mr. Harlow Shapley, in his recent studies on the colors and magnitudes in stellar clusters, states that the similarity in the frequency of colors for near and distant clusters shows that the selective scattering of light in space, if acting uniformly, affects the color indices of stars by less than two-millionths of a magnitude for each parsec of distance. With any reasonable assumption as to the dependence of light-scattering on stellar concentration, interstellar media appear unimportant in their effect on the colors of stars brighter than the fifteenth magnitude.

**Size of Planetary Nebulæ.**—Measurements of the parallaxes of nebulæ are beset by obvious difficulties, and comparatively few satisfactory measurements have been made. The most recent investigation in this field is that of Adriaan van Maanen, of the Mount Wilson observatory, who has measured the parallaxes of six planetary nebulæ with the 60-inch reflector of that observatory. From the parallaxes it is possible to deduce the size of these objects. The largest of those measured (N. G. C. 6720) has a diameter of 10,000 astronomical units; the smallest (N. G. C. 7662) a diameter of 1,350 astronomical units (major axes in both cases). The diameter of the orbit of Neptune— *i. e.*, the diameter of our known solar system—is only 60 astronomical units.

**Meteorology of the Solar Eclipse of June 8th, 1918.**—An analysis by Messrs. Kimball and Fergusson of the data obtained at 55 Weather Bureau stations lying within the zone of 90 per cent obscuration of the sun during last summer's total eclipse shows that, in general, the fall of temperature was comparatively small; owing perhaps to the cloudy weather that prevailed along the path of totality. Changes in barometric pressure were small and irregular; changes in wind-direction rather large but irregular. As in previous eclipses, the greatest changes of conditions occurred, in most cases, between five and twenty minutes after the passage of the shadow. There are evidences of inblowing and outblowing winds around the area of totality, suggesting a circulation similar to that found in the eclipses of 1900, 1901 and 1905.

**The Problem of Solar Rotation** is reviewed in a recent paper by C. St. John, in which he assembles the large body of data thus far obtained by means of spectroscopic measurements as to the linear velocity of solar rotation at the equator. The data, obtained by several observers, extend over a period of 21 years, and the values range from 1.86 to 2.08 kilometers per second. Measurements of the speed of the sun's rotation are complicated by the fact that the sun is not a solid body, and its rotation varies with latitude; also, as shown by studies at Mt. Wilson, with altitude; *i. e.*, different rates of rotation are found at different levels in the solar atmosphere. Lastly, local convectional currents in the sun's atmosphere, though they may have little effect on average values, make it difficult to discover possible short-period variations in the speed of rotation. Hubrecht has found evidence that there is a difference in rotation between the northern and southern hemispheres. It is very desirable to have an extended series of determinations made by the same observer and at the same time to keep the instrumental conditions unchanged. Such a program has been under way at Mt. Wilson for five years and it is hoped to continue it through a whole sunspot cycle.



New type of submarine 340 feet in length doing 24 knots under steam. Note the three 4-inch guns, two forward and one aft; also the two smokestacks, which fold down when the submarine submerges. Displacement submerged 2,700 tons, speed 10 knots

# The Submarine Situation

## The Submarine with 12-inch Gun a Fact—and Some Other Facts

### By C. H. Claudy, Special Correspondent of the SCIENTIFIC AMERICAN in London

PRYING submarine facts out of the British Admiralty is something like prying an argument in favor of naval drinking out of friend Daniels—it can't be done! Oh, they will all talk, these very polite Admiralty people, but they first find out if you "play cricket" (English for being "on the level") and then they bind you to secrecy. You mustn't tell. The Admiralty doesn't want submarines too much talked about. And if you ask them why, you get something like this: "The peace conference has just begun. No one knows what it is going to say about submarines. It is possible that it will be decided that hereafter there are to be no such things as submarines. If it is decided that the submarine has too many indecent possibilities—as was decided long ago in the case of poisoning wells and the use of poisoned bullets or mushroom bullets—then there would be no objection to telling every one everything we know about submarines. But if submarines are to continue to be a naval weapon, we don't want to give away all the things we have learned. And Germany has by no means any monopoly on submarine building progress!"

After you hear anything like that, of course, you just fairly itch to take some of these submarine people and shake them by the heels in the hope that some submarine facts will drop out. Indeed, a few have dropped out, my way, which I can repeat; but I have the feeling that there is a lot more behind which they won't tell.

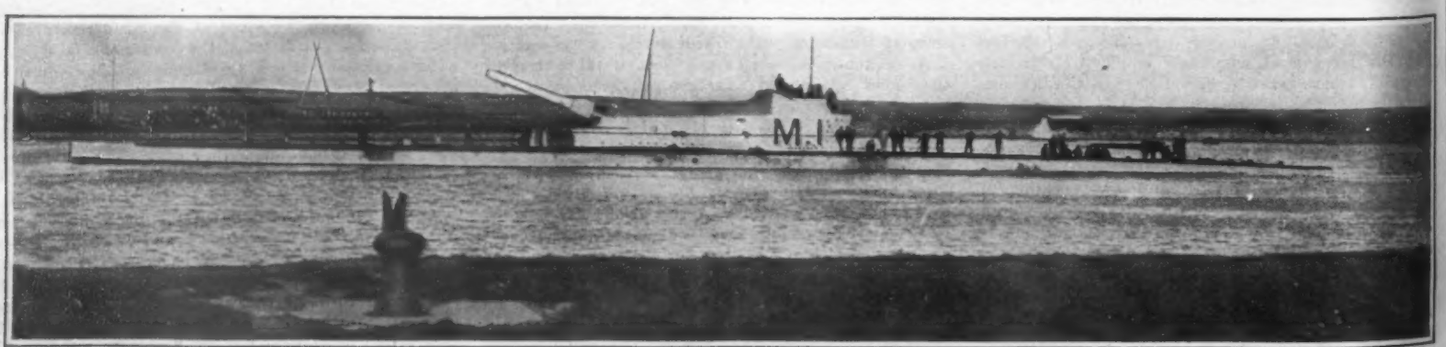
For instance, the use the British navy made of submarines during the war. They haven't said much about it, but the British submarine seems to have played a rather large part in anti-German-sub work. It seems that it was a very large factor in convoy work, and that one of the reasons why we managed to land a couple of million men in France was because British subs were constantly on the job. A collection of them—number would be deleted by the censor if I knew it and put it in—would meet all the convoys as they approached the German submarine zone and accompany the troop ships and destroyers in. This fact was carefully allowed to come to Germany's notice. The result was that German submarines immediately became very much more cautious than they wanted to be. A German submarine could lie on the surface waiting for the approach of a convoy known to be due, and sight it, from its low position in the water, long before it could be sighted. It would then be comparatively easy to submerge, keep the convoy in range and choose ship and time for a torpedo shot. But if the German submarine commander felt that every instant he was on the surface he was under possible observation from a British submarine periscope, and that he, in turn might momentarily expect a torpedo to arrive and make torpedoish remarks against his frail skin, he immediately became very chary of that lying-in-wait stunt and did his waiting around pretty well awash and his looking for victims through periscopes.

A periscope sounds very nautical and optical and devilish. Actually it is a very inefficient substitute for clear vision. And while the immunity of convoys of troopships coming from America may be accounted for in half a dozen different ways—convoy destroyers, smoke screens, airships, careful plans, what you will, there is a knowing smile on the face of the British submarine authority which says that, in his belief at least, the strong moral effect of the presence of British submarines accompanying all convoys in, had a lot if not most to do with it!

British submarines were largely used in patrol work in the North Sea where also their moral effect was felt. Doubtless they laid mines and doubtless, too, they made German mine-laying submarines have a more difficult time than would otherwise be the case. Laying a mine via a submarine sounds very easy, but as a matter of fact it isn't. A mine-laying submarine—there is a German mine-laying submarine now lying as an object of exhibition off Westminster Bridge—has a series of wells forward, which hold three mines each. The mines are released by pulling a lever inside, one lever for each mine. The mines are prearranged with anchors and cables of the proper length and they must be laid, therefore, all in a certain prearranged and specified place, otherwise they will be too deep for effect or so close to the surface that they may be seen. To find a specified area from the deck of a ship, in fine weather, and with no enemy about, is one thing. To find the same area by dead reckoning, in bad weather, from a submarine which is dodging balloons, airplanes, destroyers and other submarines, is something else again! And there appears small doubt that Fritz had it by no means all his own way even with his very efficient explosive-egg-laying undersea boat. It is reported, for instance, that over 12,000 British mines were laid from March to November by one flotilla in one locality (Heligoland Bight) and while by no means the work only of submarines, submarines were an indispensible part of the work. Sir Eric Geddes has said that "as the German navy would not come out in force, our submarines and mine-laying boats, had, day after day and night after night, entered huge German mine fields off Heligoland and blocked the channels through which some German boats left and returned. These trap mines led to over one hundred German craft being caught during the first six months of 1918."

There seems to be a general impression abroad in the world that Germany had almost a monopoly on submarine devising, and that the rest of the world stood by in amazement or humbly followed in the master's footsteps. This, of course, is "all rot" as any British submarine officer will tell you. He will go further and tell you that British submarines are much better than German ones, and then prove it! And he makes no bones at all of saying that the 160 or so sub-surface boats which Germany has surrendered contain no "secrets" not known already to British officers, and one of them at least volunteered the information that the plans for many a German submarine had been seen and examined before ever there was one captured of the same type—which would seem to indicate, if true, that Germany had no monopoly of secret service efficiency!

However that may be, it is certain that while submarines do not carry paravanes for avoiding mines in fields—for the paravane is too elaborated and complicated a device for a submarine, the efficiency of which consists largely in its ability to rise, "look—see" and dive




A real super-submarine, mounting a 12-inch, 50-ton gun, and built for bombarding the forts at the Dardanelles Straits. The British call this vessel a monitor-submarine

again, an efficiency which would be largely interfered with by any such additions to its bow—while they do not carry paravanes they do have some method of avoiding mines. I wish I could tell you what it is. One hears all sorts of rumors. One hears of a wonderful electrical device which "nullifies" the potency of mines brought within range of the "nullifying" waves. One asks the Admiralty authorities about it, and they doubt one's sanity—and small blame! But some sort of a mine avoiding ability British submarines must possess or they would never have been able to do the work they undoubtedly did do in locating the entrance and the exit to the mine protected areas from which German submarines were wont to come and go.

England started with some 80 submarines, built about 130 during the war and lost about 50—probably largely by mines before the anti-mine device, whatever, it is, came into being. During this building campaign she learned how to build submarines as she never had known before. Of course she captured some German submarines and doubtless took some ideas from her enemy, but she developed some ideas of her own which Germany never dreamed of—the M1 for instance, which is a 1700-ton submarine carrying a 12-inch gun. No, I am not romancing—the M1 exists. She was built for the Dardanelles operations and while she was completed too late for that purpose, she was a technical success. She fires, of course, only fore and aft, the gun having a traverse of perhaps six degrees and only a moderate elevation. Nor does she use a full charge, but sends her 620-pound shell a maximum of 15,000 yards. The M1 carries a couple of tubes and anti-aircraft gun. I wish I could send the SCIENTIFIC AMERICAN more particulars and additional pictures but I haven't the necessary jimmy to open the Admiralty safe!

I had the pleasure of going all over the surrendered submarine U.C. 95 with her British commander, and seeing for myself how the Hun arranges his sub-surface pirates. After one gets used to the chaotic appearance of the interior—which looks as if some one had made a collection of scrap machinery, and had thrown all the levers, wheels, pipes, rods, wires, gages, indicators, valves, gears and ducts in the world, haphazard at a long slender tube interior and made them stick where they struck—one begins to notice things. One very striking fact is that there is no brass on the U. C. 95 although she is otherwise thoroughly modern. She was built in 1918, a mine-layer, and seems in fine condition. But except for the brasses in the engine bearings she is brassless and copperless, all her valve wheels are white metal or iron.

Another fact which sticks out like a sore thumb is that she was evidently built to be lost, not to last. There has been no such thing as accessibility considered in her fittings. For instance, the ventilating fan—the captain called my attention to its hum, and said that, of course, they could stop and start it. But they couldn't locate it exactly and that if it broke down and had to be repaired it would apparently be a dry-dock job! Nothing in her has been planned with the idea of easy access or repair—very evidently she was put together with the belief that long before she would need an overhaul she would be captured or destroyed.

Her engines, two six-cylinder 300-horse-power at 450 revolutions per minute heavy oil engines, were, according to the young British commander, models of their kind, sweet-running and efficient. Her two periscopes, one used from the conning tower and one from the control station just aft the mine laying compartment, are beautiful examples of Carl Zeiss, Jena, optical work. But they possess no focusing device for eye-accommodation which would make them most indecently difficult to use if one's eyes were not strictly normal. She carried a crew of 40, and five officers—and she had sleeping accommodations for eight of the crew and two officers! There is no place to eat, save the bunks, no place to live, save the bunks! Room simply doesn't exist on her—indeed, the puzzle is where the 40 men are placed themselves. Of course, much of the crowding is due to practically all the space forward of the conning tower being devoted to mine wells, storage room and galley but even with all that room available for living quarters, the U.C. 95 is a mighty crowded vessel!

Courtesy Illustrated London News

**Bow view giving end-on view of 12-inch gun, which has 6 degrees traverse**

It was interesting to learn that men small physically are preferred in submarine work, not so much because they take up less room than larger men, but because of the fact that a submarine sailor or officer must wear a great many clothes to keep warm, and a big man can't put on enough and still have room to get swiftly through the hatches! The temperature of a submarine in winter, it seems, rarely rises above 40. If the engines are running the hatches must be open to supply air and the amount used is enough to make a veritable cyclone come down the hatchways. Result, interior temperature is always low. If submerged, and no air moving through the boat, the temperature is kept low by the temperature of the water outside and the fact that the engines, a source of heat, are not running! Consequently, every one piles on sweaters and leather coats and woolen underwear and fur gloves until the diameter of the hatchway limits further protection!

There is a wide divergence of opinion to be heard regarding the disposition of the surrendered submarine fleet. Admiralty officers not connected with the submarine service generally think the submarine should be abolished and the surrendered boats sunk or distributed to various nations sinply as exhibits and curiosities. "Of course," they will tell you, "*our* fellows can play the game and *did* play it—*we* torpedoed no helpless merchantmen and shelled no open boats with defenceless women and children, nor stood by and laughed while enemy crews drowned! But other people, apparently, can't. And if they can't, then the submarine ought to be abolished and all those in existence sunk."

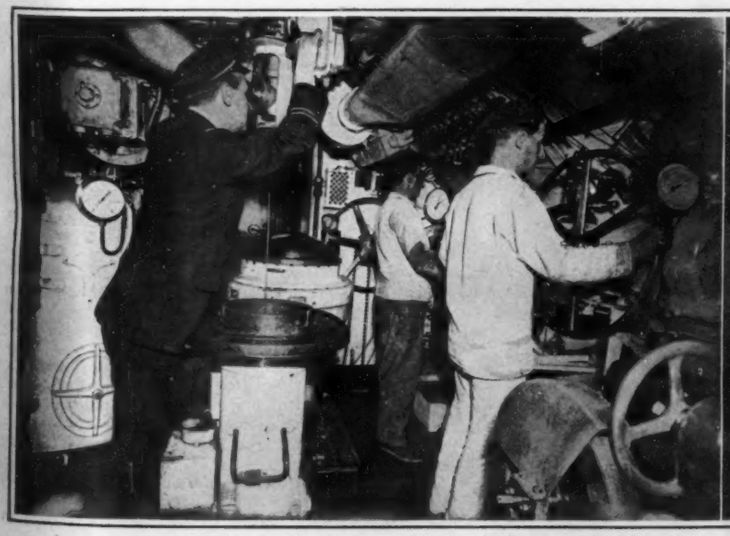
This point of view, natural enough in a nation which hates Germany under the sea as she never will hate her on land, won't hold water with a parallel argument. No naval authority wants to abolish seaplanes, yet airplanes were used to bomb hospitals and murder defenceless women and children in church, home and school. The submarine-service man, of course, points to the work his branch has done during the war, and his absolutely clean record, and asks why a perfectly good weapon must be abolished from the world's navies because a blackguard, a man who doesn't "play cricket," a beast with no understanding of the dictates of humanity in warfare, happened to misuse that same weapon? Of course, no one knows what the Peace Conference may decide, and it may very well avoid a possible source of discord by agreeing to destroy all the captured submarines rather than try to distribute them—but it seems a frightful waste of good material.

## Electric Welding in British Ship Construction

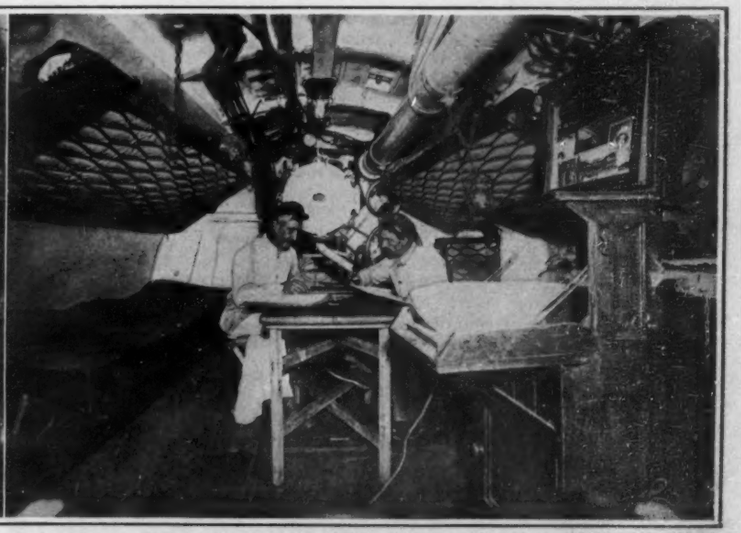
A LARGE British electric company has issued a pamphlet on the application of its system of electric welding to ship construction. This is the system that was employed in the first rivetless ship, the launching of which was announced in July last, and it has also been approved by Lloyd's for use instead of riveting in vessels intended for classification in their Register Book.

For the last two years the company has been investigating the problem involved from two aspects—on the one hand testing the relative strength of welding in various types of joints and under all conditions of stress, and on the other determining the modifications of design necessary or desirable with welding. Some of the results obtained under both these heads are given in the pamphlet, and are held to show that a suitably-designed joint, welded by this process, is not merely as strong as a riveted joint, but is in fact substantially stronger, and that the various modifications in design evolved by the company overcome many difficulties encountered in the usual methods of ship construction.

It is pointed out that a mere tensile or bending test is not a sufficient criterion of the strength and suitability of a welded joint, and two joints welded by different processes may give approximately equal tensile results, but show a marked difference when subjected to alternating stresses. Thus on tensile test there may be little to choose between two joints, one made by a skilful welder using a bare wire or ordinary slag-covered electrode and the other by means of arc electrodes; but on an alternating torsion test the latter, it is stated, may be expected to stand at least 200,000 alternations, while the former will usually fail at less than half that number.



**View in the operating room of a French submarine, showing periscope, and diving and steering controls**



**Living and berthing quarters on the same submarine. Note folding bertha table and washstand**

# Influenza—The Sphinx of Diseases

By Wade W. Oliver, M.D., Professor of Bacteriology, The Long Island College Hospital, Brooklyn

WHEN we speak of the cause of a disease, we are guilty of an error. Any given disease has many causes. For purposes of convenience and exactitude, the causes of a disease are divided into two classes (1) the exciting cause and (2) contributing causes. The contributing causes of influenza include such factors as overcrowding, universality of travel, promiscuous coughing and sneezing of individuals suffering from the disease, etc. The exciting cause of influenza, *i. e.*, the particular germ responsible for setting up the infection, is not known.

It is a curious and suggestive fact that, in regard to exact knowledge of the exciting cause of a number of our most common diseases, we are almost as woefully in the dark as was Hippocrates, "the Father of Medicine!" The list of diseases of doubtful or unknown causation includes such common maladies as small-pox, mumps, whooping cough, measles, scarlet fever, and influenza.

Leaving out of consideration, for the moment, the recent world-wide epidemic of influenza, whose toll of death so sardonically abetted the ravages of war (in this country alone, estimates place the number of deaths from influenza during the past three months at from one-quarter of a million to three hundred thousand), we find that there are few ailments which are responsible for so general a physical, mental, and economic impairment as are "common colds." Universal attention has been attracted to this malady because of its apparent recent outbreak in epidemic and pandemic form, erroneously termed "Spanish influenza." Confusion has been worse confounded by loose statements in both the "lay" and "medical" press that "Spanish influenza" is really bubonic plague, or what is commonly spoken of as "the black death." In the rapidity of its spread, in its high mortality, and in certain of its manifestations in the body, the disease has somewhat simulated, in certain respects, the pulmonary form of plague, that dread scourge of the tropics. But just as one, or even several swallows, do not make a summer, so do certain similarities fail to establish the identity of two distinct diseases.

In 1892 Dr. R. Pfeiffer, of Berlin, described a germ which he believed to be the cause of influenza and, in honor of his discovery, the micro-organism has come to be known as "Pfeiffer's Bacillus." It is a tiny rod, one of the smallest known disease-producing bacteria, averaging from 0.5 micron to 1.5 microns in length and 0.3 micron in thickness (1 micron=approximately 1/25000 of an inch. In 31 cases suffering from epidemic influenza, he found this germ in the sputum coughed up from the lower air passages. Independently, and in the same year, Canon claimed to have found the same germ in the blood of influenza patients.

Pfeiffer based his original argument that the germ discovered by him was the exciting cause of influenza upon the following grounds: (1) The influenza bacillus was found in the pus-laden sputum coughed up from the lower air passages (bronchi) in all uncomplicated cases of influenza. (2) He claimed to have found this germ only in cases of influenza. (3) He found the bacilli corresponded with the course of the disease and that when the purulent (pus-containing) secretion from the bronchi ceased, the micro-organisms disappeared. (4) He claimed to have simulated, in essential details, the disease in rabbits and apes by injecting into the veins of these animals a pure culture of living influenza bacilli suspended in bouillon.

Weichselbaum (1892), Huber (1893), Kruse (1894), Richter (1894), Baumler (1894), Borchardt (1894), rather quickly confirmed Pfeiffer's work as regards the presence of the influenza bacillus in the sputum of patients suffering from epidemic influenza, findings which have been reported by many competent bacteriologists since that time. The second and third of Pfeiffer's contentions, viz., that the bacillus is found only in cases of influenza and that when the secretions cease, the bacilli disappear, have been somewhat discredited by the work of subsequent investigators. In the bronchial secretions of persons convalescent from the disease, the bacillus of Pfeiffer not infrequently persists for long periods of time and even may occur in the throats of normal, healthy individuals for years. His fourth contention, *i. e.*, that in rabbits, by intravenous injection of pure culture of B. influenza, influenza-like symptoms were set up, is not generally agreed to by more modern bacteriologists, nor is his statement that by rubbing a pure culture of the bacillus within the nose of monkeys he was able to set up influenza-like symptoms in these animals.

When to this is added the fact that, even as early as 1892, sputa were reported from influenza patients, during the course of rather widespread outbreaks of influenza in Europe following the great pandemic of 1890-92, in which persistent search failed to show the presence of Pfeiffer's bacillus, although other germs, such as the streptococcus, were found almost if not quite as constantly in the sputum of influenza patients, germs which had as much or as little scientific license for being considered the cause of the disease as did the bacillus championed by Pfeiffer, we are given a curiously pertinent insight into the not infrequent orthodoxy of science. Truly, we, in whose eyes science has almost the stature of a god, must walk a little more humbly within "that frail and ill-assured edifice of knowledge" wherein we dwell. Until the past year, the Pfeiffer bacillus has occupied an almost unassailable position in the halls of Bacteriology and only now is the conception that this germ is the true cause of influenza being shaken from its high altar.

Fuel for the fires of scepticism is added in the form of such experiments as those referred to in an editorial in the issue of the SCIENTIFIC AMERICAN of February 1st, very recently performed by the United States Public Health Service and the United States Navy (Some Interesting Though Unsuccessful Attempts to Transmit Influenza Experimentally, Pub. Health Rep., 34:33, Jan. 10th, 1919). In the series of tests made at Boston, 68 men from the naval detention camp at Deer Island were inoculated with pure cultures of the influenza bacillus, with secretions from the nose and throats of patients in the early stages of influenza and with the blood of individuals afflicted with influenza. Living influenza bacilli, suspended in sterile salt solution, were sprayed or swabbed into the noses or throats of these volunteers, as were both filtered and unfiltered secretions from the

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# Industrial Coöperation as a Factor in Reconstruction

By Frank B. Gilbreth, Mem. Amer. Soc. Mech. Engineers and L. M. Gilbreth, Ph. D.

THE war is over. This fact has been known and realized in France and England for several months. In America it is not as yet fully realized. The next thing is to return to business.

In returning to business we must remember that the first step is to get down to scientific methods, to discover, install and maintain methods that insure permanent progress. Many programs have been suggested as "best" and as "positively essential." Secretary Lane has said that whatever our views, "we must realize that the era of the sovereign workman has come." The president of a great manufacturing association has stated that its members and employees generally "must realize that longer hours and lower pay must be the order of things or this country cannot meet foreign competition." The advocates of a high protective tariff and the believers in free trade have presented their doctrines as the solution of the problems confronting our nation. Secretary of Labor Wilson issued an announcement to the effect that regardless of conditions prior to the war, during the war it was for labor's interest to make as large individual outputs as possible.

English labor unions now insist that a Shop Committee of workmen shall have a voice in every installation of new methods in management.

In all these recommendations one feature stands out clearly, namely, that there must be a recognition of the mutual advantages of hearty coöperation between employer and employees and the disastrous effect of strikes and lockouts on employers and employees and on the public.

It has often been thought that the interests of employers and employees are and always will be, directly opposed, but there are many intelligent investigators who maintain that these interests are not opposed as is generally believed.

The purpose of this paper is to bring to the attention of the workers, managers and employers a basis of action for the beginning of a systematic coöperation that will be of greatest importance not only for their welfare but also for the welfare and prosperity of our entire nation.

The great problem of obtaining coöperation can obviously be divided into subsidiary problems, and we can select such of these as embody identical interests of all parties.

Let us list some of these sub-divisions on which there is no question of conflict of interests, and examine them with the idea of fostering special coöperation on these subjects, and thus make a start in founding habits of intensive general coöperation in management and workers.

Such a list of non-antagonistic sub-divisions of management would look something like the following:

1. Accident prevention.
2. Fatigue surveys and the elimination of unnecessary fatigue.
3. Coöperative stores.
4. Regulation of temperature and ventilation.
5. Maintenance of hygienic conditions beginning with education on the subject of danger of spitting on the floors.
6. Oral hygiene.
7. First aid rooms for the sick or injured.
8. Shower baths and lockers for clothes.
9. Cafeterias, lunch rooms and casinos.
10. Playgrounds and flower gardens.
11. Annual picnics and shutdowns for vacations.
12. Coöperation with public libraries.
13. Education.
14. Bicycle racks and garages.
15. Reduction of labor turnover.
16. Mutual aid and sick benefit associations.
17. Laboratories for research in best methods.

There is nothing new about any of these 17 subjects. They can be seen individually in operation in many plants, great and small, and some organizations have them all working in greater or less degree.

The great work already done in accident prevention is well known. The number and extent of injuries from accidents in many organizations have been reduced to but a small fraction of previous records. The descriptions of the methods that can be adopted for reducing accidents are obtainable by any one by examining the reports and transactions of the National Safety Council. There are cases on record where organizations have reduced accidents over 80 per cent by accident prevention education. Every accident affects the injured most, but the employer and public are also affected by the loss of output and productivity involved in each accident.

Fatigue surveys with the elimination of unnecessary fatigue opens a field for national waste elimination that is colossal in extent. There is probably no field that offers such opportunities for savings in discomfort, for increases in output and for prolonging years of productivity as does fatigue study. The important work of Prof. G. F. Blessing of Swarthmore College should be known to every manager and shop committee as outlining a practical method of arousing interest in fatigue.

The recent discovery that 81.13 per cent of our soldiers have been misfitted with their shoes (from 71 per cent to 71.29 per cent too small and 9.84 per cent with shoes too long) has resulted in foot measuring devices invented by Mr. Elmer Jared Bliss and now adopted by the Army. The new device insures practically 100 per cent perfect fit and with untold saving of fatigue and discomfort not to say also actual injury to our soldiers.

Many organizations are already recognizing the first Monday in December each year as fatigue elimination day, and are making special efforts for coöperation on this subject with their workers, and it is hoped that this practice will become more universal as years go on.

Coöperative stores are much more common in Europe than in this country, but there are many successful cases that can also be cited here. The usual practice is for the employer to furnish the space and for a committee of workmen to operate the store. This results in large savings to the workers.

The regulation of temperature and ventilation far too often is everybody's business, hence nobody's business. Many times those sitting by the window object to

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# Correspondence

**The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.**

## Synthetic Investigation of Organization

To the Editor of the SCIENTIFIC AMERICAN:

The magnificent conduct of our men in the trenches has been paralleled for two years at least by matchless deeds at home. To this employment records of all war industries bear testimony. From the railroad president dollar-a-year man to ministers and lawyers working their time and overtime as laborers and riveters, the American workingman, newly composite, has fought a noble fight.

On the other hand, the very opposite is also the case, and the monstrous overhead, the creation of thousands of high salaried positions for disproportionate brains, the opportunity to graft more easily than ever grafting could be done before, has resulted in strange confusion.

Before the war, even, System had become a forgotten cult replaced by Efficiency rampant. The highest aim of a corporation was to so functionize its personnel that human beings might be blue-printed like machines. A stenographer who could not "take four hundred a minute" was below par, a machine operator whose arm motions were slightly under count, was undesirable.

Tests of all kinds controlled. Men of a certain type, height, nationality, were accepted for certain occupations and all others rejected. Schools sprang up everywhere. Just as one saw the finished product of the loom in a given time from the disappearance of raw cotton into the comber, so any man or woman could enter school and emerge after some months qualified for high salary as an efficiency or welfare worker.

In the case of cotton, it is either dirt or cotton that goes through the comber. In the case of the human being, no two elements were alike. Yet they were swallowed in the husk by Industry, and "efficiency" was still the dominant word. No one realized that the most shining examples of efficiency occurred where Genius as the Head had been able to support the industrial structure with selected departmental genius.

When the war was started, "efficiency" was more than ever the word, and we all know how splendidly it served as a basis to start from, and how little it could be adhered to in the event. If we had not had the idea of building fabricated ships, shipbuilding might have been paralyzed, and yet the fabricated ship has played no very glorious part in the war. If German efficiency had not convinced us that the super-training of men was necessary, we should not have our present splendid military organization. But super-trained troops did not bear off all the laurels at the Marne.

So it was with our factories. In spite of enormous numbers of efficiency men, in spite of inspectors, sometimes, as in a recent case, at the ratio of one inspector to four workers, in spite of speed and need for speed, the amount of rejected material was astounding, the overhead alarming.

There is a flaw somewhere. May we not say that it is in efficiency, not in its aims but in its ruthless methods? In its homogeneous adherence to forms and in its institutional training of men and women?

We find on our records people of the leisure class of all ages who performed sustained manual labor at record speed month in and month out, side by side with skilled labor that turned floater and lost its earning capacity. No longer can be demanded exclusive types of men.

I would not belittle the true Efficiency, the desire to excel which has turned American wide-awakeness and enterprise to such eminent accomplishment, but I do say that this excellence cannot be maintained by mechanical methods—by settled forms.

Let us then reorganize under a new name, both qualitative and quantitative, and call ourselves Synthetic Investigators.

Sympathetic, it might almost as well be, for the quality of sympathy, intuition, call it what you will, is the quality that puts the right man in the right place, that shows the Captain of Industry where to locate, where to find his market, how to build his credit, and above all what use to make of the brains of his associates.

The Synthetic Investigator too, must be endowed with this quality above and beyond all training. He must be able to live the life of the factory he is investigating as completely as he breathes the air. He must study existing conditions from the employer's point of view, and the employees' point of view, and from the intersection, which always exists for the thoughtful person, he may take his departure in his recommendations. His report must show that he has observed the elements that go to make union or disunion, duplications, interferences, inflation or over-concentration, lack of coöperation, and above all, misfits. He must save his forms for the last, to be the uniform, made properly and to order, for an organization deserving the distinction.

To do this, he must know much of human nature, and be able to see more sides than one. His special mental equipment is worth all the training in the world, and his place is in the employment service.

This most vital spot in the management of any productive concern, I believe that for such work women are particularly adapted. So far when women have worked in employment, it has been in the hiring of women, or in keeping records under the supervision of men, or, as in one notable instance, as the inspirational estimator of men's ability. That should not be the case.

Welfare, that other much abused word represented by exponents so often well-trained, so often as cold and patterned as chilly squares of linoleum mosaic, should belong to employment. Food, Lodging and Care should belong to employment. Amusement, Preliminary Hiring and Final Discharge, being the great media through which may be determined the unspoken forces of an industry, also belong to Employment.

But the means at hand, however plentiful, is lost if the investigator is the product of education solely, and devoid of the knowledge of human nature, which is the distinct necessity in the choice of personnel upon which all business ultimately depends. It gives that touch of sentiment to organization without which in some form, I know of no really successful individual or corporation.

Instead of laying stress on our profits from production, we should boast of increased loyalty and contentment, of a saving due to a minimum turn-over. This, I venture to predict, will be the better item of the two in dollars and cents, and certainly far more economical and creditable.

It is plain that many large employers now feel this. The time has come when Efficiency must join hands with Welfare. Entrusted to conscientious exponents, trained and inspirational, industrial organization will be carefully examined, and the pride of the expert will be, not in how many factories he has squeezed into the mold of his forms and system, but in the successful resourcefulness and adaptability of which his system is the foundation.

GENEVIEVE W. MASON.

New York City.

## A Definite Plan for Physical Reconstruction in the Devastated Areas

To the Editor of the SCIENTIFIC AMERICAN:

We all know that parts of France have been destroyed by the invader; perhaps we are not all clear as to the extent to which the destruction has been carried. We may therefore revert to M. Tardieu's address of November 8th last, in New York, where he stated that in the devastated area 350,000 homes have been demolished; 90 per cent of France's spinning and weaving industry put out of action; 83 per cent of her pig iron production cut off; 70 per cent of her steel production similarly affected; an equal proportion of her sugar industry destroyed. In this region, which formerly paid one-quarter of the taxes collected by the French Government, everything has been carried away or destroyed; literally nothing is left. All this must be rebuilt. How?

"We have lost two and one-half million men. . . . A fifteenth part of our people is missing at a time when we need all our material and moral forces to build up our life again. . . . But beside this restoration we must understand rapidity of execution is a primary condition of the reconstruction of France, and that the United States by its immense possibilities of production must be our first aid."

In brief, there is nothing in the way of building materials, equipment, domestic utensils, industrial machinery, that is not needed in very large quantities and at once.

The Construction Division of the United States Army has here in America 30 million dollars worth of building materials that have never been used. When to this is added all the material of like nature from the other departments here and in France, when to this is added what can be salvaged from the demolition of army plants and civil plants that must be abandoned, the figures become staggering. The Construction Division alone has purchased bakeries enough to bake two million one-pound loaves of bread per day. Out of one group of temporary office buildings alone there will soon be available 125,000 chairs, 25,000 good office desks, as many typewriters, electric fans and other equipment in proportion. And so it goes on all sides.

Inventories are being prepared showing materials on hand. It will take some time to complete these. Meanwhile it is safe to say that the equipment which was used to house, clothe, feed, doctor and nurse, entertain and safeguard morally and spiritually 4,000,000 men as no body of men were ever cared for before, will go a long way toward the quick reconstruction of communities aggregating 350,000 houses, at least until such time when a new generation may without suffering and want provide for itself more in accordance with its own taste.

Moreover, the Construction Division of the United States Army, one of the most effective organizations of the sort that ever was got together, is still intact. It still possesses its construction equipment, with the operation of which it is familiar. Its labor in connection with the conduct of war is almost finished; within a few months it will have been disbanded. To allow it thus to disintegrate while this great construction demand exists would be an economic crime. The majority of these men would be willing to go to France if they could continue their present organization and be permitted to work by the methods that they have made so successful. At the invitation of the French Engineering Societies and the French Government, a representative body of American engineers is now in Paris conferring with the French regarding maintenance and construction of all kinds for the devastated areas. When that delegation returns to this country and advises as to the exact state of affairs, we should be ready to take instant action.

In a word, let all building material and other equipment owned by the United States Government, both here and in France, and purchased for war purposes, be collected. This will include material not yet used as well as that salvaged from the demolition of war plants. Let all such material as can be used in the reconstruction of France be turned over for that purpose, and delivery expedited to the utmost of our ability. Let the Construction Division of our Army, or such part of it as can profitably be so employed, go to France to coöperate in the utilization of this material. Finally, let all this be considered as a part of the cost of the war to be included in the bill against Germany.

Germany has done this destruction. The principle of reparation is accepted. But reparation by cash payment is notoriously inadequate; and direct reparation is slow and uncertain. We, however, are in the ideal position to bring about speedy and effective reconstruction; while slowness of payment, provided ultimate payment be properly secured, is of not the least consequence to us. And cash payment, when thus made to us, loses its inadequacy. Let us make reparation, then, and let Germany pay us for doing it for her.

Is there a better solution? I am sure that there is not.

JOHN V. SCHAEFER.

Chicago, Ill.

## Another "Original" Toothless Saw

To the Editor of the SCIENTIFIC AMERICAN:

Here is an earlier date for a toothless buzz-saw than any I have seen mentioned in your paper. When I was a young boy (born in 1838), I lived from 1845 to 1851 eleven miles northeast of this city. One day I walked two miles to see a wood-turning machine shop owned by John Joslyn who turned handles, posts, rounds, etc., for various kinds of pioneer furniture and implements. He took great interest in showing me the various machines, and lastly attached to the lathe shaft a toothless disk six inches in diameter which he had cut out of a plate of common sheet iron. Giving the disk a very rapid motion he cut through a large steel file several times, a stream of sparks flying 20 inches or more away. I know this was previous to 1851 because my family moved from that vicinity in March of that year, and as it was warm weather when I visited the shop, it could not have been later than the summer of 1850, and probably not earlier than the summer of 1849. I have these dates before me in my father's autobiography. I think the idea of that particular saw was original with Mr. Joslyn.

I have been a continuous subscriber to the SCIENTIFIC AMERICAN for forty-five or six years and consider it is the most instructive journal published, and expect to take it as long as I live.

C. W. BENNETT.

Coldwater, Mich.

## That Big Navy

To the Editor of the SCIENTIFIC AMERICAN:

We want to congratulate you on your editorial with reference to the foolishness of building a great navy.

We are in thorough accord with your ideas—and we, like your publication, have always been strong believers in a big navy. However, it seems utterly foolish now and we are mighty glad that you handled the subject as you did.

E. R. ARMSTRONG.

Chicago.

# Airplanes for the Transatlantic Flight

## What Aircraft Constructors Are Doing Toward Making the Great Flight Possible

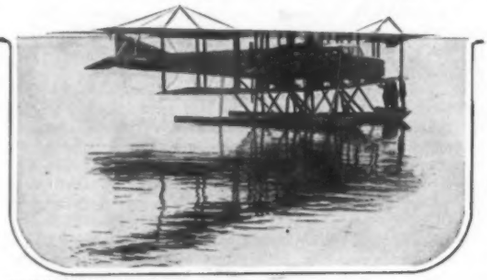
IF it were merely a matter of providing a suitable machine, the transatlantic flight would by now be a *fait accompli*. For it is a well-known fact that Great Britain, Germany and the United States, and perhaps France and Italy as well, have several airplanes now available for the crossing of the thousands of miles of ocean. Other factors have deterred aviators from making the attempt, although many signs point to the successful accomplishment of the feat within the next few months.

Among the transatlantic airplane possibilities is the seaplane of Capt. Hugo Sundstedt, a Swedish aviator now in America, who has more or less completed his preparations for the great trip. Sundstedt's machine at the present writing is riding on waters of Newark Bay, off the southern end of Bayonne, N. J. As yet the machine has not received its final tests preparatory to the first leg of the transatlantic journey, which is from Bayonne, N. J., to some point on the Newfoundland coast.

The mount designed and built especially for Capt. Sundstedt is a biplane of huge proportions, resting on two long pontoons. It has exceptionally graceful lines as compared to the squatty appearance of similar sized machines of the flying-boat type. The upper plane has a spread of 100 feet, while the lower plane measures 71½ feet. Between the wings and well in front of them is the cabin from which the craft is controlled and piloted. Back of the cabin stretches the fuselage or framework terminating in a simple épenage or tail. The cabin is provided with four seats upholstered in artificial leather —two for the two pilots and two for the two mechanicians who are to make the trip. All the controls are installed in duplicate, so that if one set should become damaged or deranged, another is available. Maps and meteorological data are placed in front of the pilots, together with compasses and other instruments.

On either side of the cabin is a six-cylinder Hall-Scott engine rated at 220 horse-power, and enclosed in a stream-line casing. The engines, delivering a total power of 440 horse-power, drive two propellers. The total lifting area of the seaplane is given as 1,537 square feet. The weight is 10,000 pounds. The estimated speed is 80 miles an hour.

Capt. Sundstedt is an aviator of long experience. In July, 1914, he made an airplane flight from Buc, in France, to Stockholm, in Sweden, or a matter of 1,200 miles, without landing. The time for this trip was 13 hours and 20 minutes; and considering the comparative crudeness of prewar machines, this was no mean achievement. However, it is well to call attention to the seemingly low horse-power of Capt. Sundstedt's seaplane. Most machines of equivalent size are equipped with two engines of the Liberty or Rolls-Royce type, delivering some 800 or 900 horse-power as compared with his 440 horse-power. It is true that the Captain has made certain important improvements, such as cutting down his head-resistance to a minimum and cutting down the weight all round. For instance, his pontoons, each containing 32 compartments, are made of the lightest wood and weigh surprisingly little. But the fact remains, even if the machine is of the seaplane type as contrasted with the somewhat heavier and more cumbersome flying-boat type, that his power plant is considerably less than what is generally accepted as necessary for such sized craft. This would seem to mean that while Capt. Sunstedt's machine should be capable of flying and flying well, it is not capable of meeting adverse conditions, such as strong counter winds, which are almost certain to be met on such a lengthy flight. Furthermore, such a machine fully loaded could hardly, if at all, fly with a single motor; which means that during the entire passage the two engines must function perfectly.



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**Capt. Sundstedt's seaplane in Newark Bay, during trials**

Copyright, International Film Service

**Cabin of the Sundstedt seaplane which contains four seats and dual controls**

In a word, Capt. Sundstedt's machine, given ideal flying conditions and the very best of good fortune, ought to be able to make the transatlantic journey. But in no wise does it appear capable and ready to confront adverse winds, rough seas—should it have to alight for repairs and adjustments and then take off again, and other deterrent factors. Plainly, it does not anticipate such disadvantages. There is no factor of safety; or should we call it "factor of hard luck"?

Aside from the Sundstedt machine, the United States has another entry in the transatlantic flight in the form of our Naval machines. On February 8th, the Navy Department ordered Commander John H. Towers to take charge of the development of plans and assembly of material and personnel for the proposed flight. For the attempt the Navy has several machines available, especially the huge biplane of the flying-boat type, known as the N. C. 1, which was described and illustrated in these pages some time ago. The N. C. 1, which has carried 51 passengers in a recent test flight, is equipped with three Liberty engines or about 1,200 horse-power in all, driving three four-bladed tractor screws. The upper wing has a spread of 126 feet, while the lower one is somewhat shorter. From prow to tail she is 70 feet long, and from the gunner's cockpit on the top wing to the keel is a distance of 25 feet.

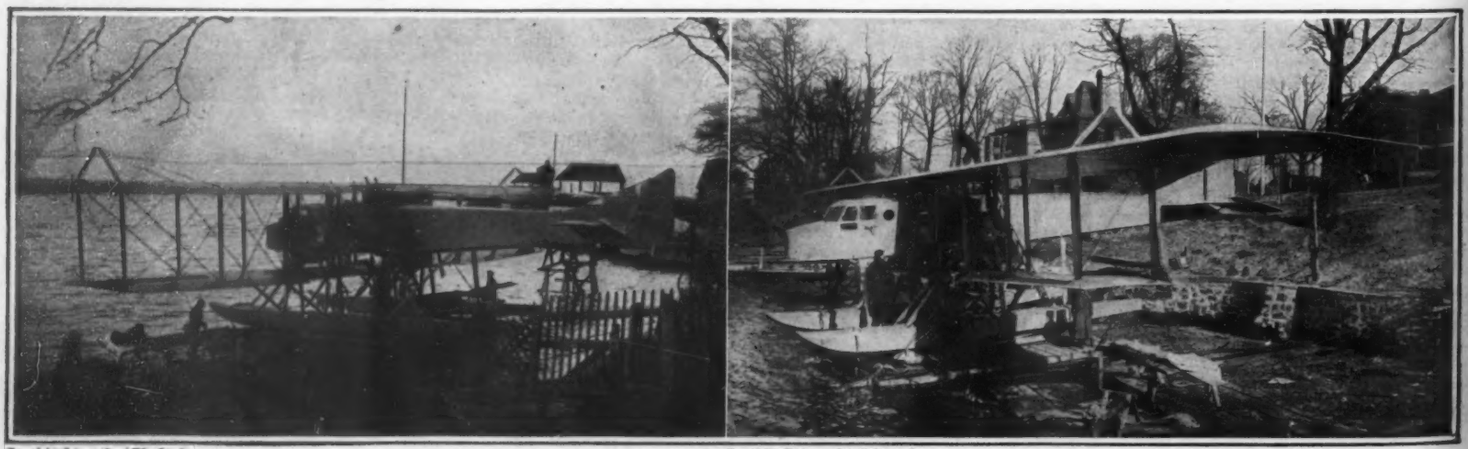
As equipped for coast-guard duty, the plane carries 300 gallons of fuel, which is sufficient for several hours' flight. However, stripped of all guns and carrying as much fuel as possible, the cruising range of this giant craft could readily be raised to 40 or 50 hours, which is more than sufficient for the transatlantic flight. The twin-engined flying boats of the Navy, which were also described in these columns, are available in large numbers. These planes, equipped with two Liberty engines, each furnishing about 400 horse-power, could be made to carry sufficient fuel for 15 or 20 hours' flight. If the transatlantic flight were made in two or three jumps, so to speak, with mother ships along the route to furnish fuel and other supplies as well as enable crews to make repairs and slight adjustments, these F-5 type planes could readily make the journey. But if a non-stop flight is to be attempted these planes may well be disregarded in favor of larger planes such as the N. C. 1.

Other planes are no doubt nearing completion right here in the United States for the avowed purpose of crossing the Atlantic, but their designs have not yet been made public.

Turning to Europe, we find our British cousins working hard to get an airplane started on the transatlantic journey. A number of machines are already available, and are receiving their finishing touches and "tuning," to be followed by extensive trial flights. One machine for the coming contest is the Porte "Super-Baby" triplane flying boat, designed and built for Lieut. Porte, who will be remembered as the young British naval officer who was to attempt the flight in 1914, but whose plans were interrupted by the war. Lieut. Porte's present mount has a span of 123 feet, a fuselage length of 60 feet, a height of 27 feet 6 inches, and a total weight of 23,400 pounds. The two upper planes are of the same span, while the lower one is somewhat shorter. The cabin is included in the flying-boat member.

One commendable feature of the Porte plane is that it is equipped with five Rolls-Royce motors of about 350 horse-power each, arranged in two tandem sets and one single "pusher." So it is evident that Lieut. Porte means to take no chances with engine failure: he has discounted the darkest kind of misfortune by having at least two engines to the good; that is to say, by having two engines more than he needs for plain flying.

(*Continued on page 215*)



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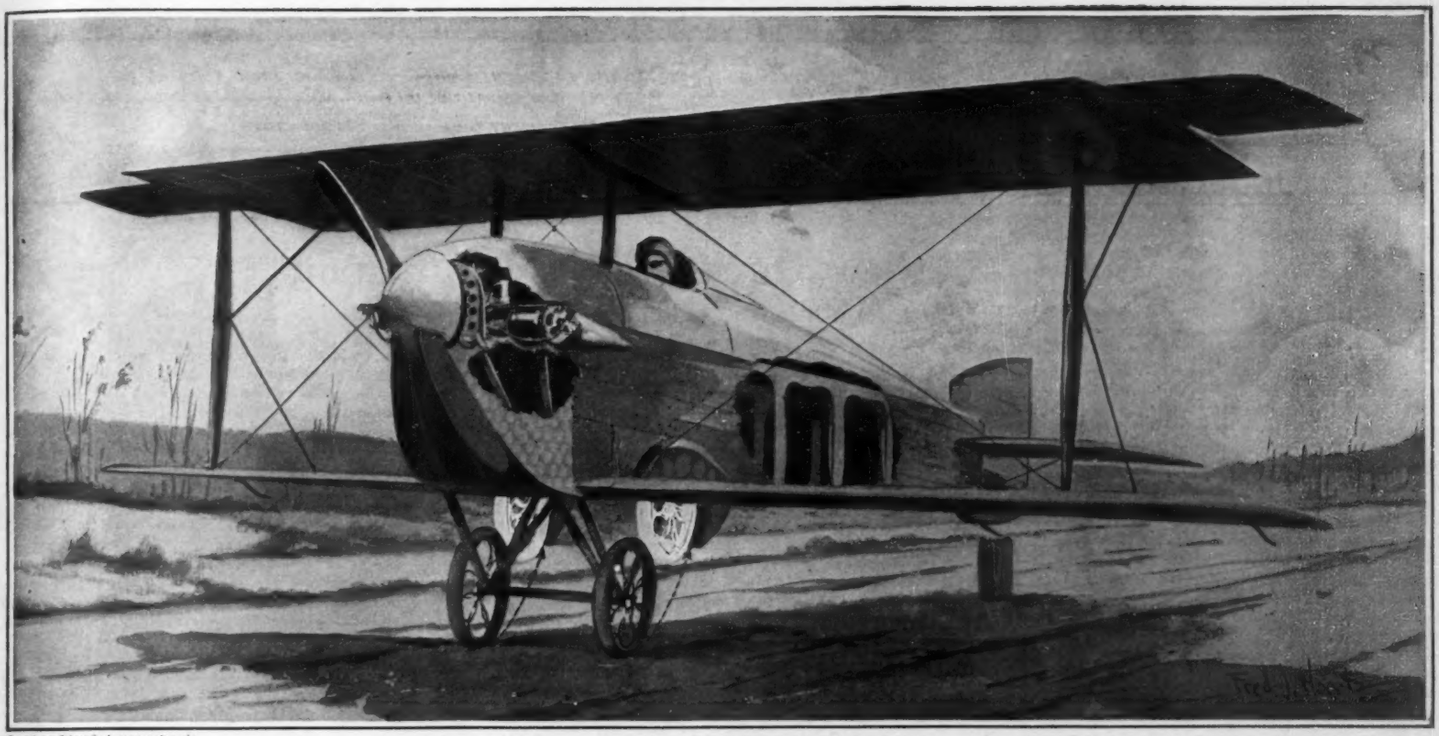
**Two views of the Sundstedt seaplane designed and built for the transatlantic flight**



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**This is the airplane for the aerial commuter. It starts and alights on an ordinary road. It makes a speed of over 100 miles an hour. And it costs no more than $2,000!**

## Every Man's Airplane—A Big Step Toward Aerial Transportation

THE cover illustration of this issue is based on solid fact. It is not an artist's vision of the future, but a drawing of what can be done and what is likely to be done at any time from now. The airplane shown exists in a practical form, and it is available at a cost which brings aerial commuting within the realm of immediate realization for all persons who have heretofore been able to afford a motor car.

The machine is a single-seater biplane, designed by of long experience in airplane design and Captain James V. Martin who will be recalled as a man operation. In reality, the machine was designed originally as an altitude fighter, provision being made for oxygen tanks and electrically-heated clothing; but with the termination of hostilities Capt. Martin has turned over his biplane to peaceful pursuits with very few structural changes.

Known as the K-3 type, the Martin single-seater biplane includes a two-seater horizontally opposed engine of 45 horsepower, which, as modern airplanes go, is very low. The fuselage construction is also worthy of note. It consists almost entirely of three-ply timber. The system of wing bracing also is unusual, as is the arrangement of the under carriage which makes it possible for the wheels and the

*(Continued on page 216)*

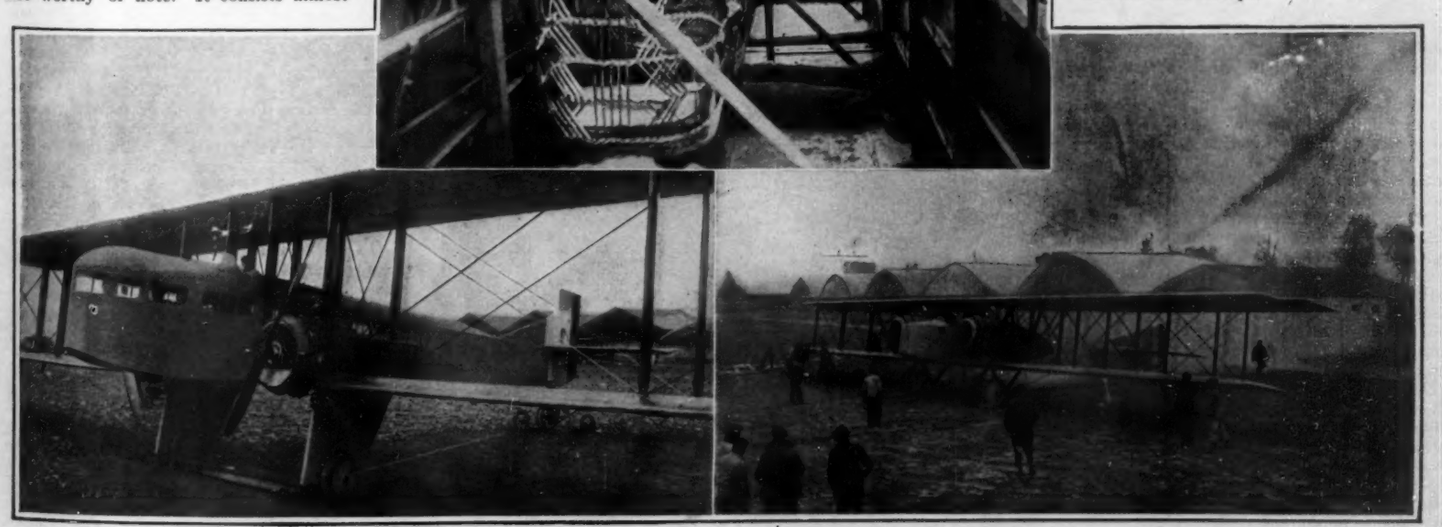
## How Passengers Are Taking the Place of Bombs in Airplanes

THREE months ago it was a question of building planes which would carry a large cargo of bombs to the distant cities in Germany. Today, the same machines are being converted for passenger carrying, and the question is one of carrying the most passengers as rapidly as possible so as to compete with the more prosaic means of transportation.

The accompanying illustrations are of immediate interest in that they show how two well-known types of bombing planes have been converted into passenger-carrying planes. The machine with the cabin body is the big Farman biplane now being employed in Paris-England service. The machine has a span of 92 feet, and can lift three tons. It can climb 1,500 feet in four minutes, 3,000 feet in 10 minutes, and 6,000 feet in 28 minutes. Two engines are used, each of 250 horsepower, giving the machine a speed of 110 miles per hour. A dozen passengers can be carried if they do not object to crowding.

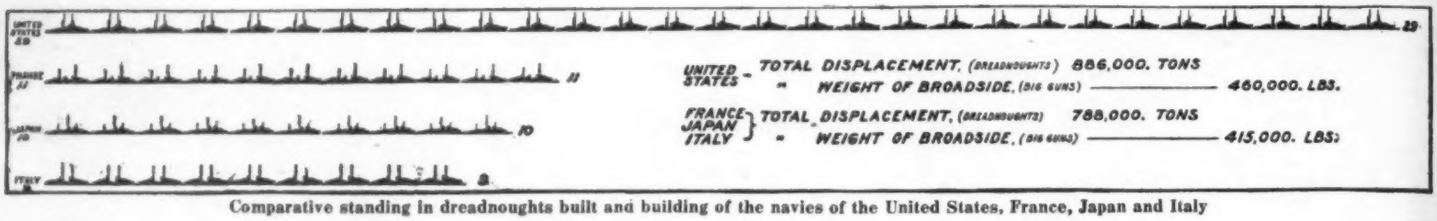
The other machine is a converted Caudron twin-engined bomber, also equipped with what appear to be radial engines of the Salmson design in both wingplanes. In the case of the Caudron, however, the fuselage is arranged with a huge cockpit so as to hold the passengers without other protection. The Caudron appears to have a wing spread about the same as the Farman, and equally powerful engines.

No doubt these machines are typical of what is being done with the Handley-Pages, Capronis, Gothas, Lizens bombers, and others in Europe.



*At the left:* The Farman passenger plane for service between Paris and England. *At the right:* The twin-engined Caudron bomber converted into a passenger plane. *Above:* The interior of the cabin of the Farman passenger plane, showing the seats and other accommodations.

**How the erstwhile bombing planes of the French are being converted into passenger-carrying planes**


UNITED STATES
TOTAL DISPLACEMENT, (DREADNOUGHTS) 886,000. TONS
WEIGHT OF BROADSIDE, (BIG GUNS) 460,000. LBS.
FRANCE JAPAN ITALY
TOTAL DISPLACEMENT, (DREADNOUGHTS) 788,000. TONS
WEIGHT OF BROADSIDE, (BIG GUNS) 415,000. LBS.

Comparative standing in dreadnoughts built and building of the navies of the United States, France, Japan and Italy

# Cost of the New Three-Year Naval Program

## Moving Up from Millions to Billions in Naval Estimates

SOME of the more conservative minds among us are feeling uneasy over the fact that the prodigious scale upon which naval and military appropriations have been voted during war times has upset the sense of values among our present government officials. Nowhere has this change been more marked than in the Navy Department; for whereas, in the years preceding the war, the conservative estimates of naval necessities by the General Board were received with positive dismay by naval secretaries and denounced as extravagant and militaristic by naval committees both of the House and the Senate, today, when the war is over, appropriations infinitely greater than those that were asked when the German menace was lifting its threatening head over the eastern horizon, are blithely presented by the Secretary of the Navy, and enthusiastically endorsed by him, not only in official reports and in hearings before committees, but in public utterances upon the platform and in the press.

One of the most commendable pledges with which the present government entered upon its high duties and undertook its solemn national obligations, was that of a careful conservation of the public moneys, and of an economy which should strike a reasonable mean between wild extravagance and a parsimony which would be fraught with national peril. Surely, if there is ever a time in the affairs of a nation when there is a call for strict economy it is at the close of a war of the first magnitude, and in the presence of the enormous debts that such a war inevitably leaves upon the shoulders of the people. The citizens of this country, who have made such a noble response to the call of their government for a curtailment of their personal expenditures so that they might make a generous response to the government call for money, feel that they have a right to look for a quick scaling-down of government expenditure now that the war is over. Hence, they have viewed with dumbfounded amasement the call of the Navy Department for the construction of a new fleet, whose cost will be equal to that of the whole of the existing fleet which we have built up during the past quarter of a century.

It is a very simple thing to ask Congress to authorize a three-year program; it is not so easy for the mind to grasp what an enormous sum of money must be expended, not merely to build the ships of that program but to maintain them year after year. It is the purpose of the present article to translate these millions and billions of dollars into concrete every-day terms, which will bring home to the average American a sense of what such expenditures actually mean.

During the discussion of the proposed new three-year program before the Committee on Naval Affairs of the House of Representatives Secretary Daniels presented an estimate of the cost of maintaining a navy of the size he was recommending. This estimate was drawn up by Admiral S. McGowan, Paymaster General of the Navy. The statement is of extraordinary interest, because it gives not only the cost of building the proposed three-year program, but also the cost of the three-year program of 1916 and the original cost of the existing fleet previous to 1916.

We find from this statement that the original cost of the fleet, exclusive of the three-year program authorized by act of August 29th, 1916, was $775,000,000. The estimated cost of the three-year program, act of August 29th, 1916, is $761,000,000; and the estimated cost of the proposed three-year program as originally proposed was given by Admiral McGowan as $913,000,000.

It must never be forgotten that providing the money to build ships is merely the beginning and not the end of the expense. The ships must be maintained and the maintenance of a fleet is an enormously costly thing. To quote from Admiral McGowan's estimate, if the 1916 three-year program and the second three-year program be completed, "the annual cost of maintaining our enlarged navy will be about $709,125,000 per annum for vessels in full commission, in reserve commission, and for the maintenance of shore stations."

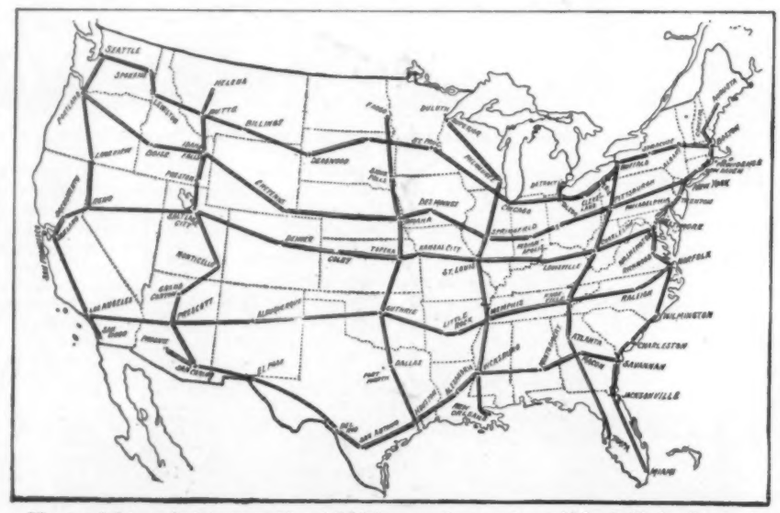
In 1913 when the threat of war existed and the menace of German ambitions was well-understood in every government of the old and new worlds, the annual cost of maintaining our navy was $138,000,000. Today, when that threat has disappeared, with Germany navally impotent for a generation to come, and with every great naval power our close friend and ally, Mr. Daniels is asking for authority to build a navy which will cost for maintenance alone over $709,000,000 per year.

Now let us consider for a moment just what these huge sums of money mean. Turning to the first page of this issue we see a group of six of the greatest and most costly buildings in New York city, including such structures as the Equitable Building ($12,000,000), the Woolworth Building ($6,600,000), the Singer Building ($3,000,000), the Pennsylvania Railroad Terminal ($13,450,000), the Adams Express Building ($3,600,000) and the Metropolitan Life Building ($8,000,000). These monumental structures, known all over the world for their size and cost, total altogether in value $46,650,000. A vast sum, truly; and yet we are asked to spend for our new navy over 16 times that sum of money.

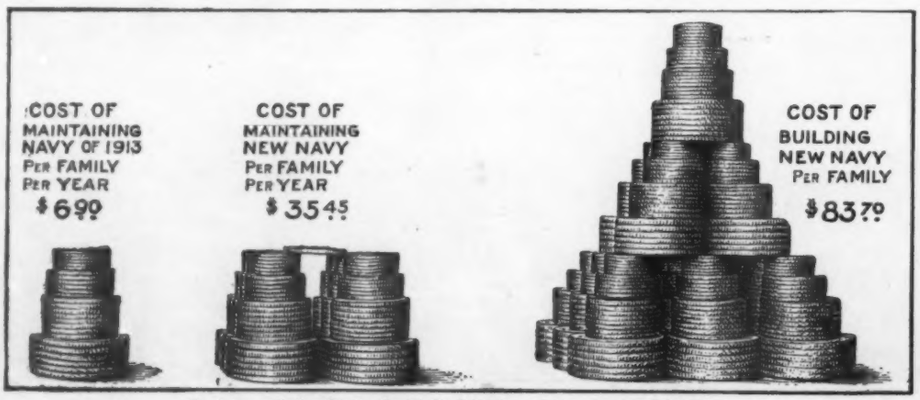
So much for the monetary end of the problem as affecting the national treasury. Let us now bring it down to the more intimate relation of the pocketbook of Smith, Jones and Robinson. The cost of maintaining the navy of 1913 was $6.90 per family per year. The cost of building the new navy, as represented by the two three-year programs, is $1,674,000,000, and this means that every family in the United States will have to contribute $83.70 to build those ships and put them in commission. When that has been done, each family, according to the figures provided by Admiral McGowan, will be under the necessity of contributing $35.45 every year to keep this fleet in commission.

It should be noted, here, that the bill as passed by the Naval Affairs Committee omitted the six battle-cruisers until they can be redesigned to incorporate the lessons of the war and this, we must remember, will reduce, for the present, the total cost as given above; but it is certain that, if the advocates of an enormous navy can have their way, these battle-cruisers will figure in the bill as finally put through. The bill, as passed by the House, calls for the ultimate expenditure of $750,000,000. If, as the SCIENTIFIC AMERICAN believes, this expenditure will be absolutely unnecessary, let us consider what could be usefully done with this huge sum of money. Nothing promotes the prosperity of a country so greatly as efficient means of transportation. We need a system of good roads throughout the United States. Now a first-class 18-foot concrete road can be built for an average cost, including both easy and difficult country, of $30,000 per mile. Divide this $30,000 into the prospective cost of this second three-year program, and you will find that the sum which the present administration professes to be willing to spend on an unnecessary addition to our navy, would build five trans-continental concrete highways from coast to coast and six concrete highways traversing the country from Canada to the Mexican border and the Gulf.

Why does the SCIENTIFIC AMERICAN consider this second three-year program to be quite unnecessary? For an answer we direct attention to the diagram at the top of this page. It shows, in silhouette, the number of dreadnoughts which will be possessed by the United States and the next three

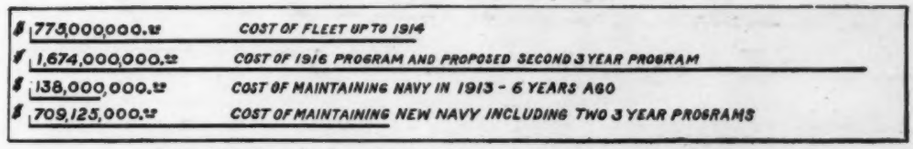



Eleven eighteen-foot transcontinental highways of concrete could be built for the cost of the new three-year program


COST OF MAINTAINING NAVY OF 1913 PER FAMILY PER YEAR
$6.90
COST OF MAINTAINING NEW NAVY PER FAMILY PER YEAR
$35.45
COST OF BUILDING NEW NAVY PER FAMILY
$83.70

Cost to each family in the United States of the proposed big navy

naval powers, France, Japan, and Italy, when our 1916 three-year program and their own existing programs have been completed. At that time the United States will possess 29 dreadnoughts, most of the them the biggest ships of their kind afloat; France will have 11 dreadnoughts, Japan 10, and Italy 9. That is to say we shall have 29 dreadnoughts as against 30 for the next three powers. But our 29 dreadnoughts will have a total displacement of 886,000 tons as against 788,000 tons for the three combined fleets of our allies; moreover, our total broadside for the fleet will be much greater, namely 460,000 pounds against 415,000 pounds.


$ 775,000,000.00 COST OF FLEET UP TO 1914
$ 1,674,000,000.00 COST OF 1916 PROGRAM AND PROPOSED SECOND 3 YEAR PROGRAM
$ 138,000,000.00 COST OF MAINTAINING NAVY IN 1913 - 6 YEARS AGO
$ 709,125,000.00 COST OF MAINTAINING NEW NAVY INCLUDING TWO 3 YEAR PROGRAMS

**This shows how the Secretary proposes to increase the cost of the Navy**

The SCIENTIFIC AMERICAN has always been a "big-navy" journal; we stand for a big navy today; and we believe that the construction we now have in hand will give us, as shown in this diagram, a navy amply sufficient to show the flag and protect our interests in all the seven seas.

## Handling Cocoanut Oil in Bulk

NEW methods of handling cocoanut oil at Pacific ports are now in successful operation. Previous to the war, the bulk of this oil was shipped to Europe, but with the closing of European ports great quantities came to the United States. It is estimated that we will receive cocoanut oil to the value of $60,000,000 during the year 1919.

Until recently the oil was shipped from the Far East in cases and barrels. The excessive cost and great waste o this led to the attempt to ship in bulk. The problem was a difficult one because of the fact that the oil solidifies at 70 degrees Fahrenheit. Experiments in running heating tubes through the tanks of vessels, storage houses and cars have now reached such a stage of practicability that bulk shipment of cocoanut oil is recognized as having arrived.

This enables tankers which have taken cargoes of refined or lubricating oils to Asiatic ports to load to capacity with cocoanut oil for delivery into bulk storage on our Pacific coast, and subsequent distribution in tank cars. One of the first companies to enter the field has set up a storage plant in San Francisco, with a complete equipment for getting the oil out of the steamer into storage, and out of storage into the tank cars. Six-inch pipe lines lead from the storage tanks to the piers and to the tracks, and all necessary couplings are made with flexible steel hose.

When the cocoanut oil is pumped into the steamer's hold in the Orient it is of the consistency of heavy fuel oil. The scheme is not to maintain it in this state throughout the voyage, but to let it freeze up as solid as it pleases while the vessel is en route. It is merely necessary to have the oil at pumping consistency on arrival; so steam is turned into the heating tubes while the ship is a day or two out of San Francisco. In the same way, the oil is allowed to solidify in the storage tanks and again in the tank cars, and steam turned into the heating tubes of these units only when it becomes necessary to reduce the oil to flowing consistency. In this way a great deal of steam is saved; in fact, it is this alone that makes the process a feasible one commercially.

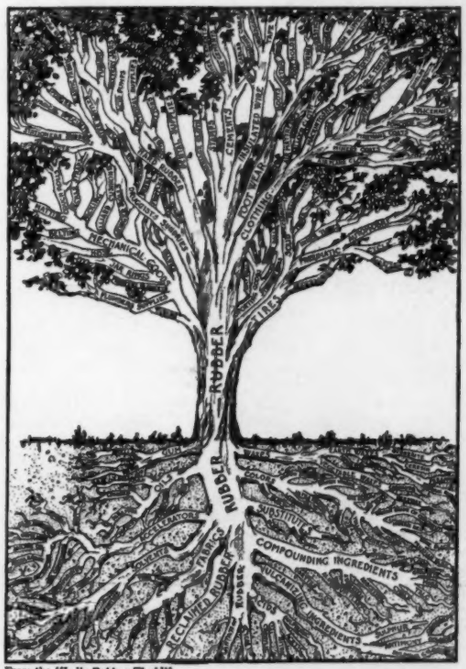
At the storage plant the oil is never purposely permitted to remain in the six-inch pipe line leading from the docks to the storage tanks. When the tanks on the vessel have been emptied, steam or compressed air is introduced into the outer end of the pipe line behind the oil, and all of the latter remaining in the line is forced into the storage tanks. Nevertheless, there is danger that the oil will become hardened in the pipe line and obstruct the latter wholly or partly. So a one-inch heating tube is carried down the center of the six-inch pipe, returning on the outside of that pipe to the boiler room. By turning steam into this circuit any oil that may remain in the six-inch line is soon melted out. The lines that are used in filling the tank cars are similarly equipped with a heating core; here, however, after filling a car the oil is permitted to remain in the filling line, to be melted out when the next car rolls into place.

The oil pumps on board the vessel and at the storage plant must be equipped with a steam jacket, or else provision must be made for the certain draining of all oil from the pump immediately after operation ceases. Oil allowed to remain in a pump that has no steam jacket would soon solidify and then a pressure of 100 pounds of steam would not suffice to clear the tubes.

## The Labyrinth of Chemistry

WHY is it that most chemical manufacturers, instead of turning out several grades of the same product, as seems the rule in most fields, produce several compounds of radically different nature, and but one grade of each? Why, in the lists of war contraband issued by the English and French Admiralties, do we find such items as tallow and ether? Why was it not possible, after more than two years earnest effort, to make American dyes as good as those previously imported from Germany?

The answer to all these questions is the same—because




From the "India Rubber World"

**The "Rubber Tree" showing the interdependence of the rubber industries**

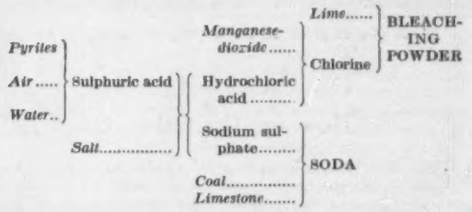
of the interdependence of the chemical industries. This interdependence must be clearly visualized not only for a proper understanding of the historical development of a given chemical industry, but likewise for an adequate grasp of its present economic state. No proper comprehension of industrial chemistry is possible without a thorough knowledge of all the curious ties which bind together several methods of manufacture having apparently no connection at all.

The classic example of this can be found at the very beginning of the production of artificial soda. Leblanc extracted this soda from common salt, consequently the factory had to be located in reasonable proximity to salt mines or marshes. He depended upon the action of sulfuric acid; and since this low-priced and very dense substance cannot support transportation charges, an acid factory had to be built in connection with the soda works. But the process of making sodium sulfate in this way involves the formation of an equal bulk of hydrochloric acid vapor; this must be recovered to avoid pollution of the air, and is then dissolved in water to form the commercial acid. So that to make an alkali it was necessary to prepare two acids. More than that, the commercial demand for soda so far exceeds that for hydrochloric acid that the full production of the latter could not possibly be sold to outside consumers. Economy demanding that the excess be used up in some way, it was transformed into chlorine and then into bleaching powder.

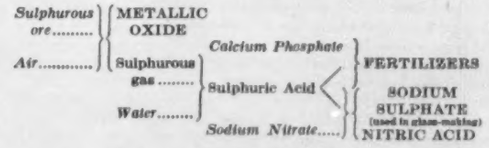
Then this old process for making artificial soda, which can be completely expressed chemically by means of the simple equation

$$2NaCl + H_2SO_4 = 2HCl + Na_2SO_4,$$

must, from the industrial point of view, be set forth in the following chart, in which raw materials are entered in italics, intermediate products in ordinary type, and finished products in capitals.



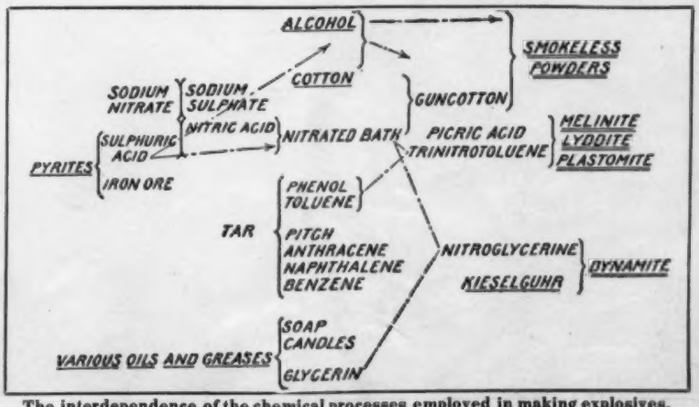

We have seen that hydrochloric acid is sometimes prepared for the double purpose of removing the noxious vapors from the air and converting them into a product of value. In metallurgical operations involving the roasting of ores containing sulfur the sulfur laden vapors receive analogous treatment. But just as the users of this acid have to make it because it will not support transportation charges, so the makers have to use it for the same reason. This they accomplish by making fertilizers and often nitric acid. They can sell these at a low price because they do not have to figure the cost of their sulfurous vapors in actual money, as an ordinary producer would have to do. Of course such facts are most important in an economic survey of the industries concerned. They may be charted as follows:



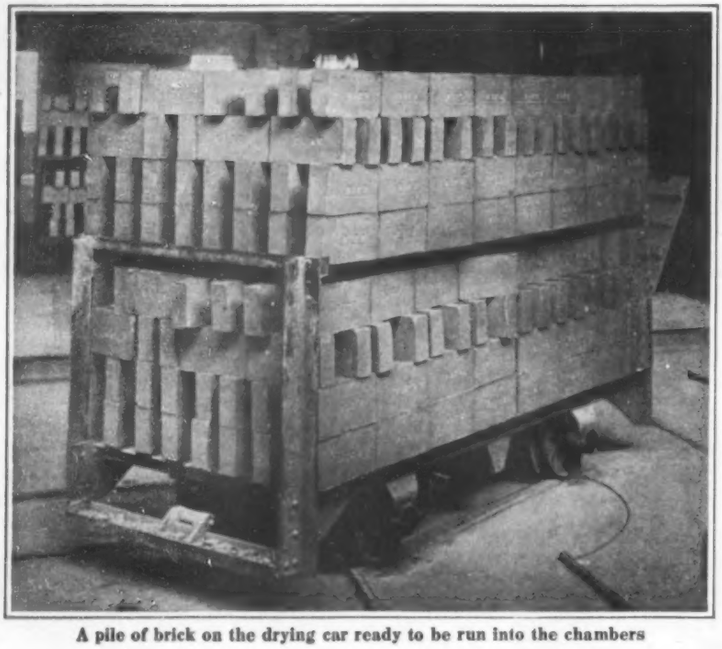

Of course, the facts set forth in these charts are sometimes modified in their relations to each other. For instance, far from being a mere waste product utilized to prepare bleaching powder, the hydrochloric acid of the first chart is in some places the chief product. This is the case in the gelatine factories, which use large quantities of this acid to dissolve the mineral constituents of the bones. In such factories, it is to be remarked that the preparation of hydrochloric acid leads to sodium sulfate as a by-product, and that the manufacture of sulfuric acid is forced as an intermediate raw product leading to the hydrochloric. Likewise in many explosive factories the manufacture of sulfuric acid was established in order to reduce the cost of the nitric acid which could then be made from it.

This nitric acid is the fundamental base of all our modern explosives; and it is for this reason that Chile saltpeter (sodium nitrate) is not permitted by the Allies to enter Germany. Reference to our third chart, which sets forth the principal ramifications of the industrial chemistry of explosives, will also explain the blockade on alcohol, ether, glycerin and cotton, in addition to showing how essential it was

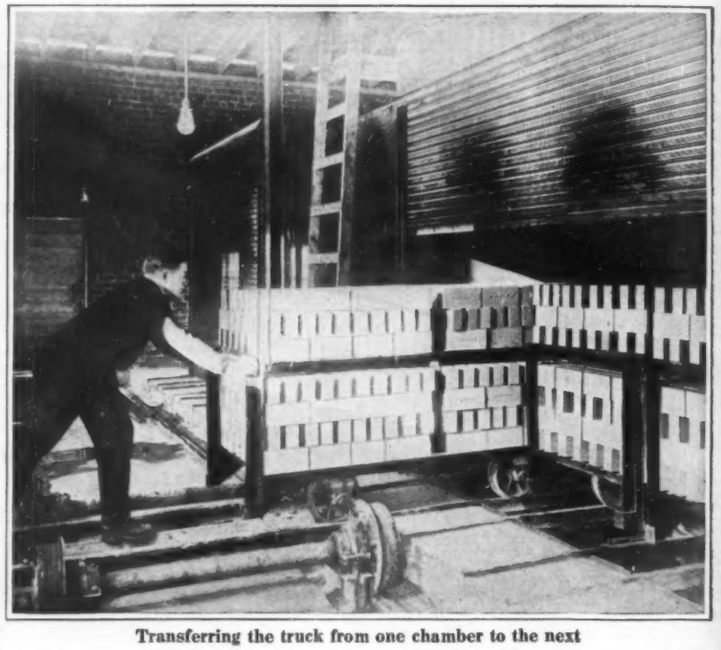
(Continued on page 216)




**The interdependence of the chemical processes employed in making explosives. Raw materials are underlined once, final products twice**



A pile of brick on the drying car ready to be run into the chambers



Transferring the truck from one chamber to the next

# Speeding Up the Drier

## How an Operation Once Left to Sun and Wind Has Been Brought Within the Mechanical Field

WHEN primitive man wanted to dry anything, he set it out in the sun. When he wanted to accelerate the process, he learned how to supplement or replace the sun's heat by artificial fire of his own. He must doubtless have observed that the question of air supply had something to do with the matter; he cannot have failed to observe the difference in drying on quiet and on windy days. But that was as far as he ever got; and that was where the matter rested until a very recent date. Means for supplying a more intense heat or a more intense draft were provided from time to time, but this represents merely a difference in degree, not in kind; the advisability, even the possibility, of regulating the heat and the air in connection with the drying operation seems to be distinctly a twentieth century conception.

Now that this idea has been developed, however, its application is being pushed in all fields where drying is done; and it has led to a fundamental revision of the technique of carrying on such operations. It is now realized that at different stages of the drying the material displays different degrees of moisture content, and that its most advantageous treatment is to be gained only by subjecting it to different conditions of heat and ventilation, suitable to these several stages. But the conditions which are not suitable for the material which has passed a certain stage, and from which, therefore, that material must be removed, are exactly suited to such of the material as is just entering the stage in question. This observation leads to the progressive system of drying, in which there are a number of stations in the drying establishment or the drying apparatus, with different conditions of temperature, ventilation and humidity prevailing at each. Every article to be dried passes successively through each station, remaining at each for the proper length of time. In addition to its more obvious advantages, this system makes it possible to conduct the drying with due regard to the fact that in certain degrees of saturation, the material is more sensitive to sudden removal of large percentages of its moisture content than it is at others, and that accordingly certain stages of the drying need to proceed slowly, under pain of damage to the substance under treatment.

This consideration is met in the seasoning of woods by the progressive system—an undertaking that has been forced upon us, in lieu of the older and more dignified process of seasoning through months or even of years, by the necessity for speed in the production of wood for airplanes and ships. When we cannot wait for the old process to work out, we must develop big furnaces for seasoning wood artificially; and this is what has been done.

Each drying room consists of a tunnel holding a train of cars of timber, the cars being advanced periodically, say six feet per day, in their progress from the wet end where they are loaded into the system toward the dry end at which the duly seasoned wood is discharged. For this purpose, a line of rails runs the length of the successive chambers. Beginning in very moist air, the drying proceeds in slowly increasing temperatures and slowly decreasing humidities, though the air used throughout must be more or less moist to avoid case-hardening and consequent injury to the wood.

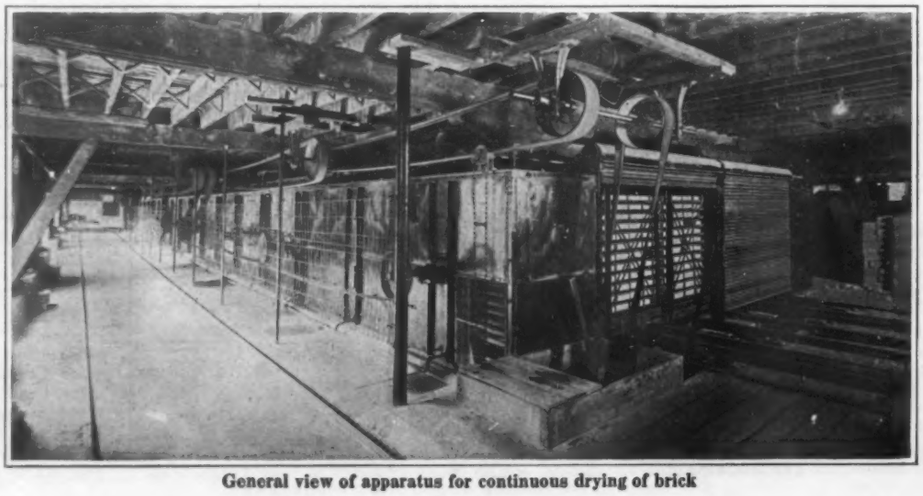
The drying agent is low-pressure steam, usually raised from wood refuse in the cheapest kind of a boiler. The latent heat of the steam is transferred to the circulating air, while the heat of condensation is returned by a pump to the boiler. Controlled circulation is assured by introducing at the loading end a little atmospheric air to chill the air to the point where it is almost saturated, and by discharging to the atmosphere such air as becomes wholly saturated. In this way a rotary circulation of air is obtained without any mechanism, the great bulk of air being recirculated and reheated on its upward travel through the steam radiators, which are suspended below the rail level.

This system is largely used both in sawmills and in private establishments throughout Britain for drying.

The progressive seasoning of wood is a British development. Other applications of the same idea may be found in this country. First to occur to us is that in the drying of vegetables, already described in these columns. Here, it will be recalled, there were something like ten trays, which succeeded one another in progress from the bottom or receiving end to the top or discharging end of the apparatus. Another instance is seen in brick-drying machinery put out by a Philadelphia concern.

Here, as in the case of the wood seasoning, the material to be treated is loaded on small cars, on which it remains throughout the operation, a loaded car constituting a unit in its progress through the drier. One of our illustrations shows such a unit, and makes clear that an important feature of any system of progressive drying lies in the manner of packing the material to be dried so that a maximum of its surface shall be exposed.

The drying chambers are arranged in a long line, and really constitute, in their totality, a big sheet iron tunnel down the middle of the building in which they are installed. The several distinct compartments are separated from one another by sheet-iron curtains of a familiar type, which roll up like a desk top when it is time to promote the various charges from each chamber to the next. With these curtains down in their working position, the chambers receive a strong draft from the sides, the whole idea of the installation being to give a strong and well controlled blast of air at all times. As in the other cases mentioned, the temperature and the humidity of the air that is blown through each compartment are carefully adapted to the needs of that particular compartment. Without control of this sort uniform and rapid drying cannot be obtained; and in particular, it cannot otherwise be assured that the several stages of the operation shall all reach completion simultaneously. When such control is once secured, however, the process is actually accelerated, since it then becomes possible to use higher temperatures and greater air movements than would be otherwise possible.

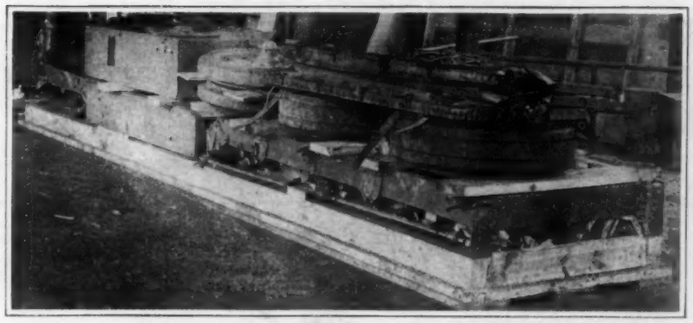


General view of apparatus for continuous drying of brick

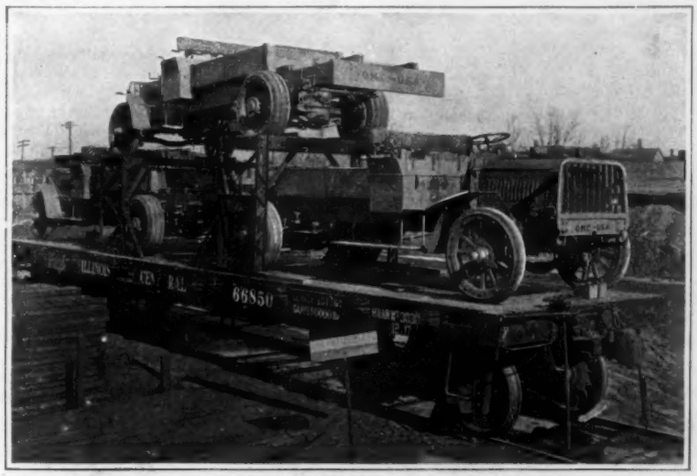
## Packing Cars for Shipment

ONE of the valuable by-products of the war is to be found in the science of packing bulky articles so that they will take up a minimum of space. The enormous quantities of raw materials and finished products that had to be shipped to and from our manufacturing plants, and the vast supplies required by our suddenly expanded army, put a tremendous tax on our railroads.

Ocean transportation was in an even more serious plight by reason of the fact that vessels were being sunk faster than they could be replaced and yet were called upon to carry across the Atlantic a vast army and far more merchandise than had ever been exported from this country in an equal period in time of peace. Naturally cargo space was at a premium and the highest importance was attached to every cubic foot saved. This led to an intensive study of methods of packing with the result that many ingenious methods were evolved. We have shown several schemes of stowing motor vehicles in railroad cars. Another such scheme which has been used to a considerable extent is shown herewith. It is a plan for stowing motor trucks on flat cars. Two cars are mounted on the main floor of the car and fill it completely but there is still plenty of room overhead and so two elevated platforms are constructed on which the wheels of a third car are supported. This furnished a good method of shipping assembled cars. For overseas transportation it was necessary to ship cars in knock-down condition, so as to make an even more compact load. Our smaller illustration shows a complete motor truck disassembled, with the parts carefully stowed in a minimum of space ready for boxing. It was by using packing methods such as these that transatlantic steamers were enabled to carry record-breaking cargoes to Europe.



A complete motor truck packed for boxing



Mounting three motor trucks on a flat car

## New Alloy That Does Not Oxidize or Change Its Form at High Temperatures

THERE is a distinct demand for a metal or an alloy that will withstand high temperatures without any large alteration in tensile strength or especially any change in its physical appearance such as scaling or oxidizing. If toughness as well as resistance to change of form are combined with the foregoing qualities, then a wide field of usefulness at once becomes possible. If the metal possessing those properties is also machinable, then its value is increased.

A new alloy is being successully and commercially made on a fairly large scale, which is claimed to possess all these properties and which is being used to advantage in several distinct fields of industrial application. It is composed of about 60 per cent nickel and 14 per cent chromium, the remainder being principally iron. It is being melted in crucibles and poured in sand molds in a special foundry for this purpose. It can be cast easily and in about any shape and in any weight up to 1,200 pounds. The fact that it can be used in practical service at high temperatures with extremely long life, compared with iron or steel, has enabled the producers to find many important industrial uses for it.

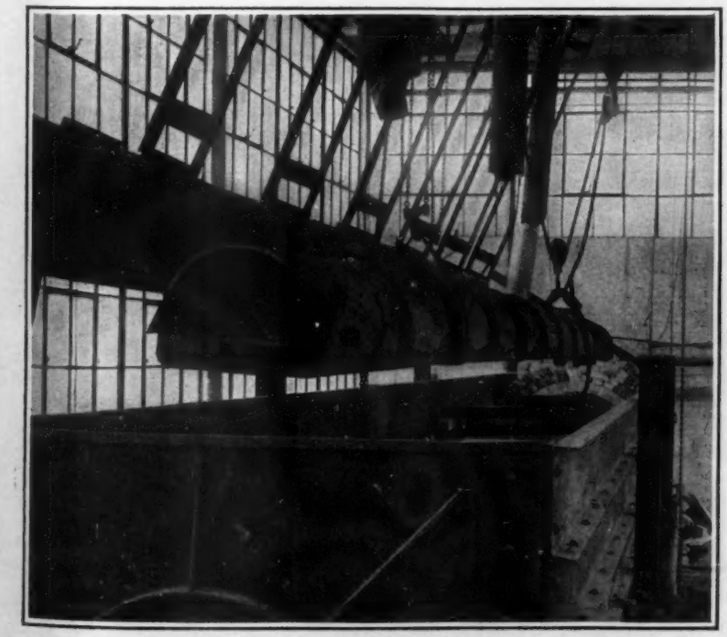
Besides its ability to withstand high temperatures up to 1,800 to 2,000 degrees Fahrenheit without alteration in form and with negligible oxidation, the new material possesses at these temperatures a strength of about 30,000 pounds per square inch. It melts at about 2,800 degrees, and when cold it has a tensile strength of about 45,000 to 50,000 pounds per square inch. In addition to its unusual strength at 1,800 degrees, it is very tough at that temperature and will bend considerably before breaking, even when red or white hot. A demonstration of this quality is often made by the company by heating to a red heat a plate of the alloy, ¾ inch thick, and then striking it often with a 20-pound sledge on the unsupported center of the plate. Stubborn resistance to bending has been the result in each case.

The general industrial application of this new alloy has broadened until it embraces annealing and carburizing boxes, heating retorts and conveyor chains used at high temperatures. It is being incorporated in the valve seats and valves of internal combustion engines, wire baskets and other utensils where either heat or acids and chemicals or both at once must be withstood. It is the claim of the company that these annealing or carburising shapes last about 6,000 hours as compared with only 200 to 250 hours for steel boxes under similar conditions. The fact that it does not oxidize and scale off enables the boxes to be made thinner and lighter, still maintaining the strength and also insuring more efficient heat conductivity.

The company itself has a practical application of the use of its product which is interesting. In the heat treatment of the alloy preliminary to drawing into wire, it is necessary to pass it through an annealing furnace at a temperature of 1,600 degrees. The ends of the furnace must be sealed with water to prevent oxidation by air. The wire is carried slowly through and out of this annealer on an endless chain. Because repeated heating and cooling would soon destroy an ordinary chain the company uses one made of the alloy itself, which has met the conditions extremely well.

Another important application is the use of this alloy as pyrometer protection tubes. This type of tubes in the cast form is said to be extensively used and to be rapidly displacing the easily broken porcelain ones. In one case such metal tubes showed a life of 4,000 hours.

The question of the use of this alloy for crucibles is now a matter of research and holds out some promising encouragement. Experiments thus far indicate the possibility of its adaptation to containers for melting brass, bronze, phosphor copper and other alloys successfully. Such a substitute for graphite crucibles would be a decided advantage under present conditions.



The new alloy in use as a trough for special heat treatment of other metals

This basket, of the new heat-resisting metal, is dipped in a hot cyanide bath without injury

# Inventions New and Interesting

*A Department Devoted to Pioneer Work in the Arts*

## Handier Hammering

THE accompanying illustration shows a novel labor saving device arranged practically to attach a mechanical hand to the hammer and let it set the nails for the hammer. In some cases one man does the work of two men with this device. In many places the carpenter needs a helper to hold the board while he drives the nail. With this device one man can do it alone, as he can hold the board in place with one hand while driving the nail with the other. A one-armed man, equipped with this device, can drive nails as well as his two-handed brother, thus opening another field of labor for him.

It is pointed out that many carpenters have been killed by falling off scaffolds while working in dangerous places, because they had to use both hands for work leaving no opportunity to hold on. With this device one can nail as far as he can reach and still hold on for safety with the other hand. It also does away with holding nails in the mouth.

It is pointed out that because of the long reach possible with a hammer equipped with this device, there are many times when no scaffold is necessary, and where one is used it does not need to be moved up so often.

This automatic nail feeder was developed at Grand Rapids, Mich., and is a light, durable device which is attached to the hammer handle, accurately feeding the nails to the hammer.

It is claimed that anyone can attach this automatic nail feeder to a hammer handle or remove it in a few seconds. After attaching it is only necessary to fill the magazine with nails, then by pulling the trigger towards the handle, the hand takes one nail from the magazine, sets it right under the hammer.

It is only required then to hold it in this position and set nail firmly into wood, releasing the trigger and the hand releases the nail and drops back, leaving hammer free for driving nail home. It is not necessary to hit the mark with the nail attached to the hammer, as might appear. It takes any kind of nails such as shingling, finishing, common, coated, flat-head, without difficulty. The capacity of magazine depends on size of nails used. It holds about 40 sixpenny nails and has a net weight of only 7 ounces.

A good running mate for this hammer is a novel nail handler which saves a great deal of time. The busy packer must have the nails all the same way in his hand if he is to make time nailing. Every time the nails are gone he grabs a handful from the keg and spends nearly a minute—an average of 45 seconds to be exact—in sorting the heads all one way. With the Handy Nail Handler he can scoop up a handful of nails, have the heads all one way, and begin nailing again in three seconds, a saving of 40 seconds over the old method.

**A magazine hammer which makes it possible to nail with one hand**

The handler is to all intents and purposes a big comb. It is only necessary to dig it into the nails, scoop up as many as it will hold, give them a quick shake so that the nails will settle on the prongs, and one has a handful of nails with the heads all arranged the same way. With the other hand one can take hold of the nails just below the handler, draw out the handler and the operator is ready to resume nailing.

**Handling nails by hand and with the comb-like instrument here described**

## A Wheel That Floats the Load

A NEW development in resilient wheels is constructed along entirely original lines. It is claimed to possess features which have long been sought, but which have either been entirely lacking or have existed in only a limited degree in so-called "cushion" wheels.

The limited amount of resiliency in the solid rubber tire and the lack of durability in the pneumatic tire for motor trucks, have led to the introduction of various types of "cushion" wheels but usually advantages gained have not been sufficient to offset the disadvantages. The most of these wheels have obtained their resiliency by means of springs, which not only produce objectionable recoil, but also inevitably crystalize and become useless.

In the new wheel there are no springs, no working parts and no parts that require renewal during the life of the truck. These wheels are practically the same weight as the ordinary solid wheels now commonly used. The axle is "floated" on a series of rubber cushions which radiate from the hub, distributing the pressure in all directions. There is no contact between the hub and the tire except through these cushions. The cushions above and at the sides of the hub bear the weight and shocks equally with those underneath—a feature perhaps never before possessed by any resilient wheel.

These rubber cushions respond to shock loads almost instantly, with very little recoil, and will efficiently absorb shocks of widely varying intensities. This is due to the ample volume of soft resilient rubber which is exposed to the strains at all times. The opposite sides of these round cushions act as shock absorbers and neutralize practically all recoil. The cushioning effect is many times as great as that of the ordinary solid tire which is limited in its resiliency to the small portion of rubber acting at any one time, and which encourages rather than controls rebound.

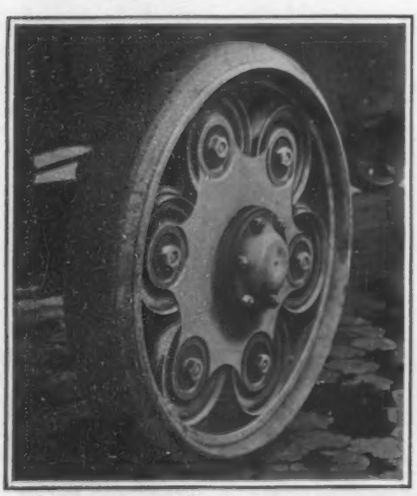
The ability of this wheel to absorb all radial, torque and side thrust shocks is obtained by each cushion being supported throughout its entire circumference, so that strains may be uniformly distributed over as much rubber as possible. Inasmuch as there is no motion between any of the surfaces in contact, there can be no abrasion or wear.

## Concrete Corn Crib to Keep Out Rats

IN England where the scarcity of food has been brought home to the people more than to the Americans, there is a law against having rats in the corncrib, and a heavy penalty is imposed on any farmer who allows rats in his storage.

Until concrete came into use in the country it was a hard job to keep the unwelcome little visitor out of the corncrib. The up-to-date farmer is using concrete more and more for building. Its lasting qualities are one big thing in its favor and in the case of protection against rats, it is about the only practical building material.

The photograph shows the interior of a corncrib built of concrete blocks which have holes in them for ventilating the building. The floor is of solid concrete, and on the sides where the blocks have openings, the inside of the structure is covered with wire mesh. The trench shown in the center of the floor is built so that the extension feeder of the corn sheller can be placed in it when shelling out the crib. Short pieces of board are laid over this trench and are removed as fast as the corn can be shelled. This trench is a labor saving feature of this corncrib. It has been found by the modern farmer that concrete is the only effective way of fighting rats.



**Wheels within a wheel, designed to give the effect of floating the load**

**The rat-proof corn crib of concrete**

# APPERSON 8

## The EIGHT WITH EIGHTY LESS PARTS

THE Spirit of Youth and Spring have their reflection in the lines and chassis of the Apperson 8. All that is vigorous and masterful, tempered and restrained by the full experience of twenty-six years of motor-car building. Power far beyond all needs in the Apperson 8 motor—the 8 with 80 less parts.

**APPERSON BROTHERS AUTOMOBILE CO., Kokomo, Ind.**

The Apperson Anniversary Model Touring and Tourster
The Apperson Standard Model Touring and Sportster
Enclosed Models for Fall Delivery

## RECENTLY PATENTED INVENTIONS

### Electrical Devices

FLASH LIGHT.—J. O'D. DAILEY, Tillamook, Ore. The invention has for its object to provide mechanism in connection with the usual hand flashlight for permitting the light to be removed from the casing without breaking the connection with the battery, and to be placed at a point removed from the battery, by means of an extension, and, as for instance, in the band of the hat, wherein means is provided in connection with the light for engaging the hat to support the same.

CUT OUT SWITCH FOR ALTERNATING CURRENT MOTOR-CIRCUITS.—E. P. BRAUNWARTH, 1873 Ralph Ave., Brooklyn, N. Y. This invention has for its general object to provide a protective means whereby the switch will be automatically opened in a simple manner when any fuse in the motor circuit is blown. A more specific object is the provision of a switch in which the blades are normally held in closed circuit position against spring tension by means of a latch, which is automatically released by magnetic means, which is in shunt with the fuse and which becomes energized when the fuse is blown.

### Of Interest to Farmers

APPARATUS FOR HANDLING RACKS.—F. J. LOVERING, Octavia, Neb. The invention has for its object to provide a device especially adapted for placing and removing hay racks and wagon bodies from the running gear of a wagon, wherein a wheel supported standard is provided, having means for lifting the rack or body one end at a time and placing it on the wagon, the device having means for locking the wheel from rotation during the lifting of the rack or body.

DRAFT TREE.—G. C. WILLIAMS, Brookhaven, Miss. This invention relates more particularly to a device embodying elements adapted to constitute a doubletree and certain of which elements are adapted to be directly connected up to form a swingletree, the objects being to facilitate the changing from one to the other, and to provide for the absorption of shocks to the draft animals in starting with a load or in pulling a heavy load over uneven ground.

CULTIVATOR.—C. BUISSON, 27 Tilton St., St. Paul, Minn. The object of the invention is to provide an implement which is especially adapted for cultivating and for pulling weeds at the same time, wherein means is provided for eliminating the weeds, roots and all, without cutting and without danger of injury to the growing plants. The device comprises a handle having oppositely extending blades of different sizes, the blades being of skeleton form and yoke shape.

TRACTOR ATTACHMENT.—S. S. THOMAS, Pampa, Texas. This invention has for its object to provide a device adapted for attachment to the rear wheels of motor vehicles for supporting said wheels out of contact with the ground, and having means for connecting the wheels to power wheels in connection with the attachment for driving the vehicle at a greatly increased power.

### Of General Interest

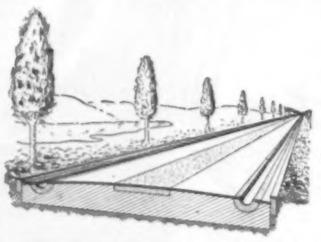
COMBINED CIGAR CUTTER AND LIGHTER.—C. H. COHN, 1712 A St., S. E., Washington, D. C. The invention relates generally to combined cigar cutters and lighters and more particularly to a mechanism including a cigar cutter, the actuation of which automatically ejects and presents a lighted match, whereby the act of cutting a cigar will operate the ejector to discharge a match from the magazine, first against a lighter, and subsequently in lighted condition, through an aperture of the casing.

FIELD GUN PROJECTILE.—C. V. RINEHART, Tucson, Ariz. The invention relates generally to field gun projectiles, and more particularly to shells of the general nature of shrapnel shells, the prime object being to provide for the timed release of missiles including propelling charges of their own, either with or without the use of the usual shrapnel ball. The projectile has a plurality of bores, auxiliary projectiles in the bores, a firing pin associated with each auxiliary projectile, and a single firing member to directly and simultaneously actuate these firing pins.

BARREL HOOP.—L. C. HOLLINGSHEAD, 208 S. La Salle St., Chicago, Ill. An object of this invention is to provide a barrel hoop shaped in such a manner as to conform to the tapering shape of a barrel, thereby securing a contact between the surface of the barrel and the entire width of the hoop and avoiding the leaving of a space between the barrel and the upper part of the hoop as is usually the case; with this device the extra operation of flaring the hoop is eliminated.

PACKAGE.—W. H. ALBERT, 120 Broadway, New York, N. Y. The object of the invention is to provide a package combining an envelope, a ticket and one or more cash vouchers contained in the envelope, the package being more especially designed for use by street, subway, and other transportation companies or by theaters or other establishments issuing tickets, and arranged to enable the patrons of said concerns to obtain a predetermined discount on each ticket bought.

CEMENT RAIL FOR HIGHWAYS AND ROADS.—J. F. O'ROURKE, 1600 East Boulevard, El Paso, Texas. This invention relates generally to roads and highways for vehicular traffic, and more particularly to safety road making means in the form of spaced parallel rails,



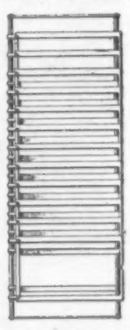
A PERSPECTIVE VIEW OF THE ROADWAY

which may be quickly constructed of plastic material, which may be molded, or laid in sections. The roadway consists of spaced parallel side tracks and a central track of which the central track has a plane surface and the side tracks longitudinal wheel-receiving depressions.

COMB ATTACHMENT.—F. E. BETHEUSER, care of Crinton, 436 W. 124th St., New York, N. Y. The invention has for its general objects to provide means for removing dirt and dust from the hair, imparting waves and luster thereto, removing static electricity, and at the same time taking the place of a brush. A more specific object is the provision of strips of velvet at the roots of the teeth of the comb so that they will have a brushing action on the hair to produce the desired result.

BILLIARD BALL.—J. P. LAMBERT, 442 W. 43d St., New York, N. Y. Among the objects which the invention has in view are to provide a billiard ball having a plurality of flat settling spots formed in the surface thereof, to add a feature of chance to games played with billiard balls, to provide means for scoring independently of the rolling of the balls, to permit a chance score and a skill score being made in games employing billiard balls, and to avoid unnecessary interference with the playing of the conventional games.

FILING DEVICE.—J. MANOWN, 742 Burdette Ave., Victoria, B. C., Canada. This invention has for its general object to provide a device, especially adapted for use in offices, stores and the like, wherein the cards are so arranged



A FRONT VIEW OF THE FILING SYSTEM

that the headings are always in sight, and information data and the like may be added at any time without taking the cards from the system. The card holders are arranged to fold against each other in overlapping relation from above downward.

INSECT DESTROYER.—F. PFEIFFER, Sr., 197 Plane St., Newark, N. J. The invention relates to means for destroying insects such as flies, ants, or the like, and has particular reference to appliances adapted to hold a poison or a viscous compound for holding the insects until they are destroyed. A further object is to provide a container or holder made of a cheap quality of paper, and substituting a fresh supply when becoming charged with insects.

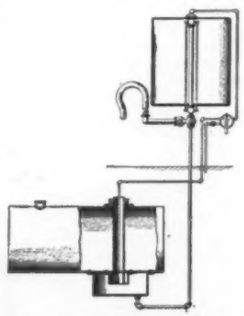
PADDING ATTACHMENT FOR EYEGLASSES AND SPECTACLES.—S. GOLDFADEN, 609 W. 114th St., New York, N. Y. The object of the invention is to provide an attachment for eyeglasses and spectacles, especially designed to enable the wearer to wear the same with the utmost comfort and without danger of irritating or further irritating, the already irritated sides or bridge of the wearer's nose by the usual clamping members. The padding is sanitary and may be quickly attached.

PAPER PADDING APPARATUS.—R. B. BONE, 273 Orange St., New Haven, Conn. The invention relates to racks for holding paper while being padded. The invention pertains particularly to a vertical rack having parallel side bars with which cooperate in a self-holding manner a plurality of flat plates which serve to prevent horizontal displacement of the paper, at the same time permitting movement of the paper in vertical lines to allow for the compression that may be applied thereto.

LAUNDRY MAILING PACKET.—E. F. REICHMUTH, 1259 E. 6th St., Los Angeles, Cal. Among the principal objects which the invention has in view are to provide a receptacle which may be easily converted into a mailing packet for laundry, to furnish a cover which is arranged to receive laundry or similar articles in the first instance for saving a second handling, to provide a packet which may be used as a wall pocket or receptacle, to provide a packet with permanent inscriptions and a receptacle for tariff stamps, and provided with means permanently attached thereto for closing the packet.

COUPLING.—J. J. JACOBS, 1161 Broadway, New York, N. Y. The invention relates to harness straps, belts, suspenders and similar articles. The object of the invention is to provide a coupling connection for connecting a strap or belt with a buckle trace hook or similar device and arranged to dispense with the doubled-up portions of the strap, and stitches for fastening the parts together, thus reducing the cost of manufacture.

GASOLINE TANK.—W. E. and C. A LEVISAY, 118 Lexington St., Covington, Va. This invention has for its object to provide mechanism for permitting any specified amount of gasoline



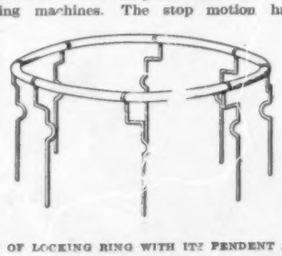
A SIDE VIEW OF THE MEASURING AND STORAGE TANK

to be withdrawn from the storage tank into the measuring tank and to be afterward discharged into a supply tank, all of the gasolene being held in an underground storage tank so that only the actual quantity needed may be delivered.

### Machines and Mechanical Devices

BOX HEADING MACHINE.—M. J. WHEELER, Peterboro, N. H. The invention relates to a machine for fastening dish shaped heads in metal or wood cylindrical box bodies by point pricking the metal or wood of the body to form inwardly extending projections or barbs which bite into the periphery of the box head. A more specific object is the provision of a work holder in combination with a plurality of piercing elements having a rectilinear and pivotal movement, operatively connected with an actuating ring.

LOCKING DEVICE FOR STOP MOTIONS OF KNITTING MACHINES.—C. R. OSTROM, Sr., 817 Murray St., Portsmouth, Ohio. The invention relates to stop motions for knitting machines, and more particularly to apparatus in connection with stop motions for circular knitting machines. The stop motion has a



VIEW OF LOCKING RING WITH ITS PENDENT ARMS

permanent fixture with a plurality of permanent pendent movable devices engageable with the stop motion mechanism to hold in the set, locked or inactive position those actuating members which are, at least for the time being out of operation by virtue of there being no thread or yarn to engage therewith.

PORTABLE PROJECTOR CASE.—F. C. TAYLOR, address C. R. Frankhauser, 450 Fourth Ave., New York, N. Y. The invention relates to cases for portable moving-picture projectors. An object is to provide a case in which when the lamp housing is in operative position the same is outside of the case, and therefore the heat generated by the lamp in the housing is not accumulated within the case and the films on the rolls are not subject to the heat and therefore to injury from being dried up.

PIPE PULLER.—S. ROBICHAUX and C. PAGGI, 3303 Montrose Bldg., Houston, Texas. The invention has for its object to provide mechanism for use in connection with pipe casings of wells, for assisting in the pulling of the pipe, the mechanism being designed to firmly grip and hold the several sections after the pipe has been lifted, and having mechanism for unscrewing the sections just lifted.

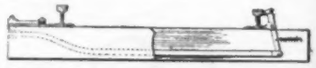
PROPELLER.—R. C. HILL, Memphis, Tenn. The invention has for its object to provide a device adapted for use with any character of vessel, wherein the propelling blades move always in a vertical position, entering and leaving the water in such position, and moving on the propelling stroke at approximately a right angle to the direction of movement of the vessel.

### Medical Devices

INTERCHANGEABLE FACING FOR ARTIFICIAL TEETH AND BACKING FOR THE SAME.—L. COOPERSTEIN, 723 E. 72d St., North Portland, Ore. This invention relates to a porcelain facing and metal backing for artificial teeth, the facing having its incisal edge inclined to its flat inner surface. The latter being provided centrally with a triangular recess whose apex is directed upward and is parallel to the incisal edge, the sides of the recess converging to said apex and being undercut.

### Railways and Their Accessories

SWITCH.—E. J. ALLISON, Whitefish, Mont. The invention has for its object to provide a switch which may be automatically operated by train carried means for opening or closing the switch at all times when the train passes in either



A SECTION OF THE SWITCH CONSTRUCTION

direction on the main or side tracks, means are also provided for opening the switch when a train is to go into the siding, and means for automatically latching the switch in open position and tripping the latching means after the train is in the siding.

### Pertaining to Recreation

TOY AIRSHIPS.—M. LUSTIG, 154 Nassau St., New York, N. Y. The invention has for its general objects to provide a simple toy which embodies a gas-inflated body for rendering the toy flotative and which has light flexible wings which assume different positions under the action of the air currents, and at one end of the body is a propeller which rotates as the wind strikes it, so that the toy in action closely resembles a flying machine.

### Pertaining to Vehicles

SELF LUBRICATING LEAF SPRING.—H. RIGBY, 899 E. 19th St., Paterson, N. J. The object of the invention is to provide a spring more especially designed for use on automobiles and other vehicles and arranged to insure a continuous lubrication of the leaves without requiring attention on the part of the owner and to reduce to a minimum the wear incident to the rubbing of the superimposed leaves one on the other. Another object is to permit of manufacturing the leaves from rolled steel stock.

FIRE PUMP.—A. M. CAHILL, 9 Lexington Ave., Highwood, Conn. The invention is intended for embodiment in an automatic pump for the tires of automobiles and other vehicles. Among the objects are to provide a pump that may be readily applied to the spokes of a wheel, to provide a sufficient range of adjustment to conform to the wheels and tires of various sizes within reasonable limits, and to provide means to set the pump in action or to stop it at will by the operator from the seat while the car is in motion.

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## The Current Supplement

ONE of the most important movements in this country at present is the revival of our mercantile marine, and in making it effective a notable feature is the radical departure in methods of construction that has been devised and successfully carried out in our new shipyards. Many fragmentary allusions have been made to the "fabricated ship," and a clearer statement of just what this term means is desirable. This will be found in an article on *Manufactured Ships* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2252, for February 29th. *Stocks and Pillories of Old England* describes and illustrates a number of these old-time promoters of morality that are still to be found in various parts of that country, although now only preserved for their historic interest. The paper on *The Chemistry of Flavoring Matter* is concluded in this issue. *America's Food Resources* calls attention to an important lesson of the war, and the desirability of a more careful study of the subject in the future. *Packing Goods for Shipment* describes the methods adopted by one large organization, which illustrate a matter of the utmost importance to every manufacturer who proposes to undertake foreign trade. *Internal Combustion Engines* is a valuable comparison of different types of motors, especially those designed for marine propulsion. It is illustrated by a number of helpful diagrams. *Modern Welding by Electricity* points out the principles, advantages and recent developments in a process that promises to have many important applications in manufacturing processes in the near future. Other articles include *The Meaning of Life* and *Stripping Negatives for Storage as Gelatine Films.*

## Influenza—The Sphinx of Diseases

*(Continued from page 200)*

air passages of patients in the active stages of influenza. In addition, ten healthy men deliberately leaned over beds of ten selected influenza patients and allowed these patients to cough directly into their faces. Not one of the 68 volunteers, developed influenza.

Certain French investigators, particularly Nicolle and Le Bailly, and Dugarric de la Reviere, have within the past few months reported experiments which lead them to believe that the primary cause of influenza is a filterable virus. (By a filterable virus is meant micro-organisms which are so tiny that they will pass special filters through which even the smallest known bacteria will not go). These experiments, which have been confirmed by certain investigators and denied by others, still await scientific acceptance. Even though they be accepted, they confess to an ignorance concerning the real nature of the living agent primarily responsible for the disease.

If, then, we are forced to conclude that it has not been satisfactorily proved that the Pfeiffer bacillus is the cause of influenza, and if there is considerable room for doubting that the disease is set up by a filterable virus, what is the present status of our knowledge? In an editorial in a recent number of one of our most widely read medical journals (*Journ. American Medical Assn.*, Vol. 71, No. 26, Dec. 28th 1918, p. 2154), the case is succinctly stated: "The primary cause of influenza, in so far as our knowledge at the present time goes, is an unknown agent that prepares the way for secondary invasions of the respiratory tract." To this confession, must be added another, even more basic in its significance. Again we quote, this time from The Report of a Special Committee of the American Public Health Association on Influenza: "While the prevailing disease is generally known as influenza, and while it may be so referred to in this statement, it has not yet been satisfactorily established that it is the identical disease heretofore known by that name, nor has it been definitely established that all preceding outbreaks of the disease styled

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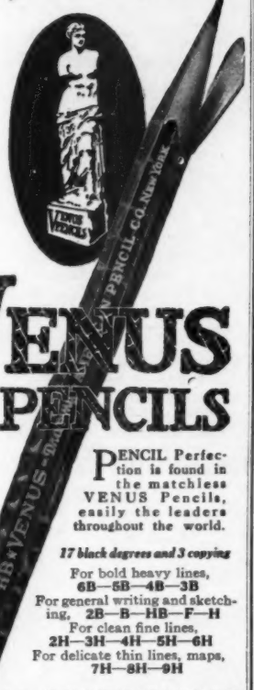


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at the time "influenza" have been outbreaks of one and the same malady. There is no known laboratory method by which an attack of influenza can be differentiated from an ordinary cold or bronchitis or other inflammation of the mucous membrane."

To the intellectually honest man, it is a wholesome corrective to be compelled to say rather frequently: "I do not know!" Oliver Wendell Holmes once wrote (Medical Essays, Houghton Mifflin, 1890, p. 11): "The best part of our knowledge is that which teaches us where knowledge leaves off and ignorance begins. Nothing more clearly separates a vulgar from a superior mind than the confusion in the first between the little that it truly knows, on the one hand, and what it half knows and what it thinks it knows, on the other."

## Industrial Cooperation as a Factor in Reconstruction

(*Continued from page 200*)

having the windows open. Many shops in America are too hot. One case was found, singularly enough in the factory of a large concern making thermometers, in which there was not a thermometer to show the heat of the rooms.

Sufficient literature on the maintenance of health already exists to transform the attitude of industry. All that is needed is to make it available to the workers and to furnish an incentive to have it read. Oral hygiene is not so well known, though that too, is gaining recognition.

First aid rooms have shown that as an immediate result of their installation the total days absent was materially reduced. The prompt prophylactic treatment of injuries makes for quicker recoveries.

Shower baths and lockers for clothes save money for the workers by enabling them to wear their old clothes longer, in fact long past the time when they would be seen on the street with such clothes.

Shower baths are more sanitary than tub baths and the cleanliness and exhilaration results in better work, more output and more personal pride in the worker.

Cafeterias, lunch rooms and casinos where workers can heat the lunches they bring or buy food give more time for play, reading and rest during the noon hour and have many other advantages, besides insuring that the workers have the right kind of food at least once per day.

Playgrounds and flower gardens have their advantages and particularly for those whose work is of a nature that calls for very little muscular effort.

Annual picnics are a custom in many organizations, oftentimes taking place on the first day of the annual shut down for vacations. Some industries are affected less by a general shut down for a week or two than by having vacations of the various members occur at different times.

Coöperation with public libraries is a common practice in America but not nearly as common as it should be. There are not only public libraries that are perfectly willing to coöperate, but there are also state and traveling libraries especially conducted for the purpose of service in industry. Many large concerns maintain special libraries of their own for the use of their employees, specializing in books pertaining directly to their industries.

Education of the members of the organization will be one of the great beneficial changes in the new era, resulting from the War for Democracy. Not only general education—for this war has taught the public as has nothing else the benefits from education—but also superspecialization in education for many of the arts and trades as well as in the professions. It is recognized that the specialist is the one who can serve his own interests best. The great work already done by the Association of Corporation Schools is well known, and the needs will soon be greater than ever. Perhaps the greatest mistake that the worker has made in the past has been that he too often has considered that his theoretical education stopped when he


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stopped going to school. The worker is more and more recognizing that this is not true. This accounts for the surprising increase in correspondence schools, which have done a stupendous good, especially in America.

Bicycle racks and garages with an air compression are almost a necessity today, and help to bring the worker's home nearer in time to his workplace.

Reduction in labor turnover on a systematic basis has been much fostered during the war, when organizations everywhere were short of workers. It has its advantage also when workers are plentiful. The hardships to workers and their families due to irregular employment and the effect on the community of their lessened earnings and productivity are now generally appreciated. The shifting of apparent misfits to other jobs in the same organizations has revealed that the management has, in the past, been as much at fault as has the worker himself in causing high labor turnover.

Mutual aid and benefit societies exclusively for employees have proved their success, yet they are comparatively rare. They provide a most satisfactory opportunity for asking the worker who has committed an act that has injured his fellow workers to contribute a gift to the society instead of discharging him. The old-fashioned plan of fining an employee and having the money go into the treasury of the employer always has resulted in abuses, the killing of hearty coöperation and a high labor turnover.

Laboratories for research in best methods have demonstrated that larger outputs with less fatigue can be obtained to a surprising degree. It is not unusual at all to find that simpler methods can be obtained, that will triple outputs and cause no more, and often less, fatigue.

With the aid of motion picture cameras we are now able to record for all time the methods of the most skilled. We can now present these pictures not merely as motion pictures—for that is their least important use—we can project them as consecutive lantern slides, examine each picture and see the motions and the recorded elapsed time of the motions of the different methods.

For the first time in the experience of the world we now have *perpetual cumulative improvement in industrial methods in form for instantaneous presentation to learners, experts and teachers.* Not only does this teach the best way known, but the manner in which it teaches reduces the time of the learning process.

This has been demonstrated time upon time in the industries. The General Staff of our Army has already recognized this fact and used this method for teaching the entire army of officers and men *the one best way*, with most satisfactory results.

Now all these 17 items here listed, as has been said, furnish a basis on which the workers and the employers can continuously coöperate. They furnish an opportunity for getting the *habit* of cooperating. Both workers and employers help themselves as well as each other by systematizing these 17 subjects even during disagreements and the most heated differences on other subjects.

There is another feature. Such cooperation will result in increased outputs. But, are increased outputs desirable? Well, the public undoubtedly wants increased outputs because they enable it to buy cheaper. The employers also want increased outputs because they can thereby get lower costs. Do the workers want increased outputs? They surely should, for only by increased outputs can we compete with foreign countries.

Before the war the workers of nearly all countries believed that small output resulted to their benefit on the theory that it results in giving employment to more people. The new workers, many of them but semi-skilled, have broken all production records.

Now the soldiers are coming back in all countries. They want their old jobs back. They should and will get them back,

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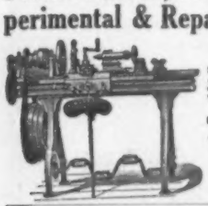

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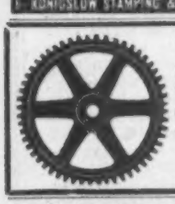

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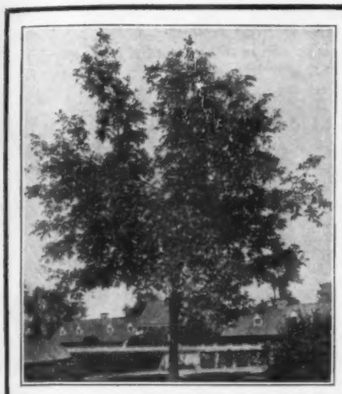

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probably did not know that an acre (50 trees) of

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will produce in a single year food equal to 60,000 eggs (as asserted by Dr. J. H. Kellog), but he did know the great value of nut trees and planted them around his home at Mt. Vernon. You may not know that at Rochester we have highly developed under severe climatic conditions the

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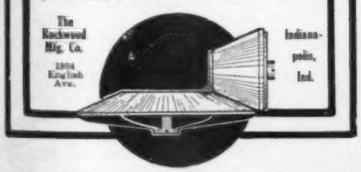




Your investment in a machine pays according to the rate-of-production; it's an investment not only in the machine but in **efficient operation** of the machine—*assured by a*

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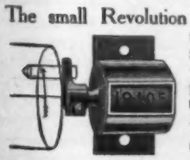
The small Revolution Counter below



registers number of revolutions of a shaft, where these correspond with the operations of your machine. A most adaptable counter for many types of small machines. Price, $1.75.

*The Veeder booklet shows counters for every machine that should have one. May we send you free copy?*

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**18 Sargeant St., Hartford, Conn.**


and the way they will hold them will be through their greater productivity due to their greater skill.

The present semi-skilled workers will do their utmost to hold their present jobs. They too will have consideration for their faithful performance during the war. The records in those foreign countries where the semi-skilled doubled the former records are well known to all. "The jig is up" as one great leader of labor has said. The worker in England, for example, now knows that England's chance in the commercial rivalry of nations is by big outputs as has been most wonderfully demonstrated during this war. The same thing is true of France.

The dawdling average German workman of the past will undoubtedly take on new life. He must and he will make almost superhuman efforts to compete and his goods will find their roundabout way to all markets of the world if the price is low enough, though they may have to consist of merely partly finished worked materials to be finished and assembled in neutral countries.

We must meet these facts. The world has changed. We are not going back to old pre-war methods, not even in surgery. The awakening to the new order of things may be read in the masterly book of one of England's greatest engineers and economists, Prof. Henry J. Spooner, head of the Mechanical Engineering Department, London Polytechnic Institute, London, England, entitled "Wealth from Waste."

Our country must accept the new order of things with which the world is confronted. This country must have maximum production which can come only by having coöperation between employer and employee. The 17 items listed in this paper form but a small part of a possible program. They afford an opportunity for an instant beginning. It is a necessity of national loyalty to make a beginning immediately. This list is varied enough to provide ample opportunity for employers and employees to make a big start on coöperation even where they have in the past believed that their interests were opposed.

The slogan must be "America for co-operation and maximum production!"

## Airplanes for the Transatlantic Flight

*(Continued from page 202)*

The Handley-Page four-engined biplane, with a pair of pontoons or some other form of marine chassis in place of its land chassis, should be available for the transatlantic crossing. In fact, it is generally understood that the Handley-Page organization is making hurried preparations for an attempt. The largest Handley-Pages with a spread of over 125 feet and a carrying capacity of 40 passengers could be modified for long-distance travel by substituting fuel for passenger space.

Last-minute advices tell of a British super-triplane which is claimed to be the largest machine in existence, now nearing completion. It is expected to make its first flight under Captain Dunn at an early date. Its capacity is enormous, and although the inside fuel tanks limit the number of passengers to 50, future machines with outside tanks should be capable of accommodating 100 passengers.

The super-triplane has six engines, presumably of the Rolls-Royce type, giving it a total horse-power of somewhere near 2,000. Everything is installed in duplicate, as in the Sundstedt machine, so as to preclude trouble with controls and accessories. It is expected to make 100 miles an hour, and to have a fuel capacity sufficient for 40 hours' flight.

Meanwhile the Germans have been developing a number of "kolossal' machines, even larger than the huge Gothas and Lixens bombers which raided British and French towns not so long ago. Typical of these huge machines is the new air giant planned by Harold Wolff, an engineer, which will have its trial at Doberitz in a few days' time.

**No More Roof Troubles**

NOW—you can cover or re-cover your roofs and *forget them for ten years.*

Simply coat them with either liquid or plastic Stormking. They will be made absolutely watertight and stormtight by this Asbestic Asphaltic Compound which neither runs or cracks under extremes of heat or cold.

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Stormking is not only inexpensive but it needs no repairs or re-painting for ten years and *we so guarantee it.*

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Apply the liquid Stormking over gravel, rubber type or corrugated iron surfaces. Apply plastic Stormking to all other surfaces whatever; especially recommended for repairing badly worn roofings.

If you have an old roof to repair or a new roof to cover, write Dept. B, for facts, costs and testimonials concerning Stormking and tell us what kind of a roof you have.

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The fact that we have been making special drop-forgings for nearly half a century is a matter of pride to us, but to you it is far more important.

Every drop-forging we make for you must measure up to the high standard that has been the basis of our long continued growth. Anything falling short of that is rejected by us and never reaches you. Forgings delivered to you are, therefore, absolutely dependable as to our workmanship and material, and can be relied upon to fulfill your purchase specifications to the last jot and tittle.

***We have every facility for making special Drop-Forgings, from the smallest to the largest, however complicated; our two complete plants at Brooklyn and Buffalo, N. Y., insure prompt delivery and the minimum of transportation delays.***

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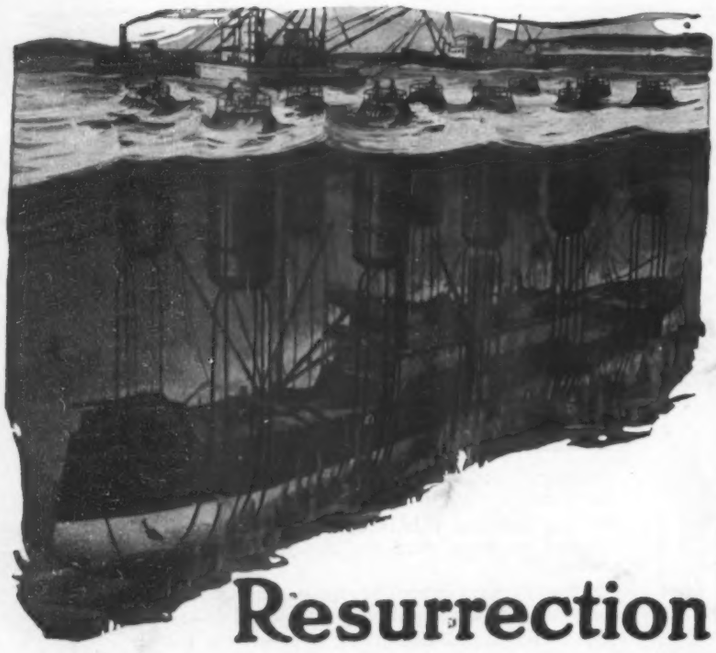

# Resurrection

**Not all the vessels that went to Davy Jones' locker at the hands at the ruthless raider will be lost to commerce forever. Many sank in shallow water. Others were beached, bow high on a friendly reef and stern awash. These were the lucky ones destined to come back. And wire rope will be their savior.**

There are many methods of raising sunken vessels. One is illustrated here. Practically all employ wire rope slings in which the vessel to be raised is cradled.

The U. S. Submarine F-4 which was accidentally sunk in Honolulu harbor in 1915, was recovered from a depth of 300 feet with wire rope.

Before the work was completed a severe storm snapped every rope but one. This was a Yellow Strand Wire Rope of Broderick & Bascom manufacture which had already served three years at railroad bridge construction on a nearby island. This is the kind of super-service that B. & B. Wire Rope users are accustomed to.

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Bend all sizes of standard or double thick steel, wrought iron, brass and copper pipe from 1-8 in. to 6 ins.; tubing from 1-2 in. to 7 ins.; round square and twisted solid stock from 1-4 in. to 3 ins.

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**Prevents cement floors from dusting—makes them waterproof and oilproof**

Soaks in and fills the pores with imperishable liquid wax. Can't wear off because it's *in*—not on—the cement. Holds the dust. Makes cement waterproof.

Unaffected by hot water, washing compounds, acids, alkalis, grease, oils, gasoline, etc. Mops or brushes on. Penetrates instantly. Floor ready for use immediately.

*A BIG SAMPLE CAN for 50c. Try it. Booklet on request.*

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The German machine is reported to have a wing spread of 166 feet and stands more than 23 feet high. It has six motors, which total 1,800 horse-power, driving two tractor screws and two propellers. Each air screw has four blades. It is said that two motors are sufficient to keep the machine in the air, hence the Germans too are taking no chances with engine failure and misfortune. The reports lay stress on the navigating devices, particularly the drift indicators, which make the lot of its pilots far more certain than usual.

The French and Italians are not believed to be ready for the attempt. The French have not developed super-airplanes to any great extent, and while the Italians have big machines in the form of their Caproni triplanes, it is understood that they have nothing ready for the moment.

So in sum the transatlantic flight promises to become a *fait accompli* within the next few months. More than one airplane is ready, not counting the large dirigibles of Great Britain and Germany which are also available for the journey, and, if anything, present a more suitable means of travel than the airplane.

## Every Man's Airplane—A Big Step Toward Aerial Transportation

*(Continued from page 203)*

struts to be folded into the fuselage during flight with a resultant reduction of head resistance. Indeed, it is said that the speed is increased some 11 or 12 per cent by the retractable chassis.

The dimensions of the machine are extremely small, the total span being under 18 feet. The claim is made that the machine can comfortably start or land on any country road, which, from the aerial commuter's viewpoint, makes the machine practical since a large flying field is unnecessary. The overall length of the machine is 13 feet 4 inches and its height 7 feet 4 inches. The total area of the wings is 100 feet and the total weight 350 pounds, including engine.

At the present writing no figures are yet available concerning the actual performance of the machine, but the estimate prepared by the designer suggests a speed of 135 miles an hour at ground level, 112 miles an hour at 10,000 feet, and 97 miles an hour at 25,000 feet. In his opinion, when fitted with a 60-horse-power engine, the speed at 10,000 feet would be 145 miles per hour.

Returning to the engine, we find that it is an air-cooled, two-cylinder opposed "Gnat" A. B. C. type, which develops 45 horse-power at 1,915 revolutions per minute. The fuel consumption is said to be 0.56 pound per horse-power per hour, the total weight of the engine being 50.4 pound. The fuel tank is placed in the upper main plane above the fuselage, and has a capacity of nine gallons or a sufficient supply for a two-hour flight. The mounting of the horizontally opposed engine in the nose of the machine and the hemispherical pot on the airscrew boss gives the machine a very neat appearance, and, although it cannot claim to possess the beautiful lines found in many modern airplanes, it is full of useful and original ideas. The machine will probably sell for about $2,000.

## The Labyrinth of Chemistry

*(Continued from page 205)*

for Germany to develop the fixation of atmospheric nitrogen.

This chart shows well the disturbance provoked in the chemical industry of a country by the necessity for producing large quantities of munitions. It is necessary to build not only factories for explosives, but also for sulfuric and nitric acids; it is necessary not only to produce dynamite and guncotton, but soap and candles and benzene. The abnormal consumption of certain raw materials, often necessitating embargoes against their normal uses; the extraordinary production of certain by-products; the diversion of great factories from their ordinary uses—all these things create conditions which turn the whole industry of a nation upside down, and throw its markets into the wildest confusion.

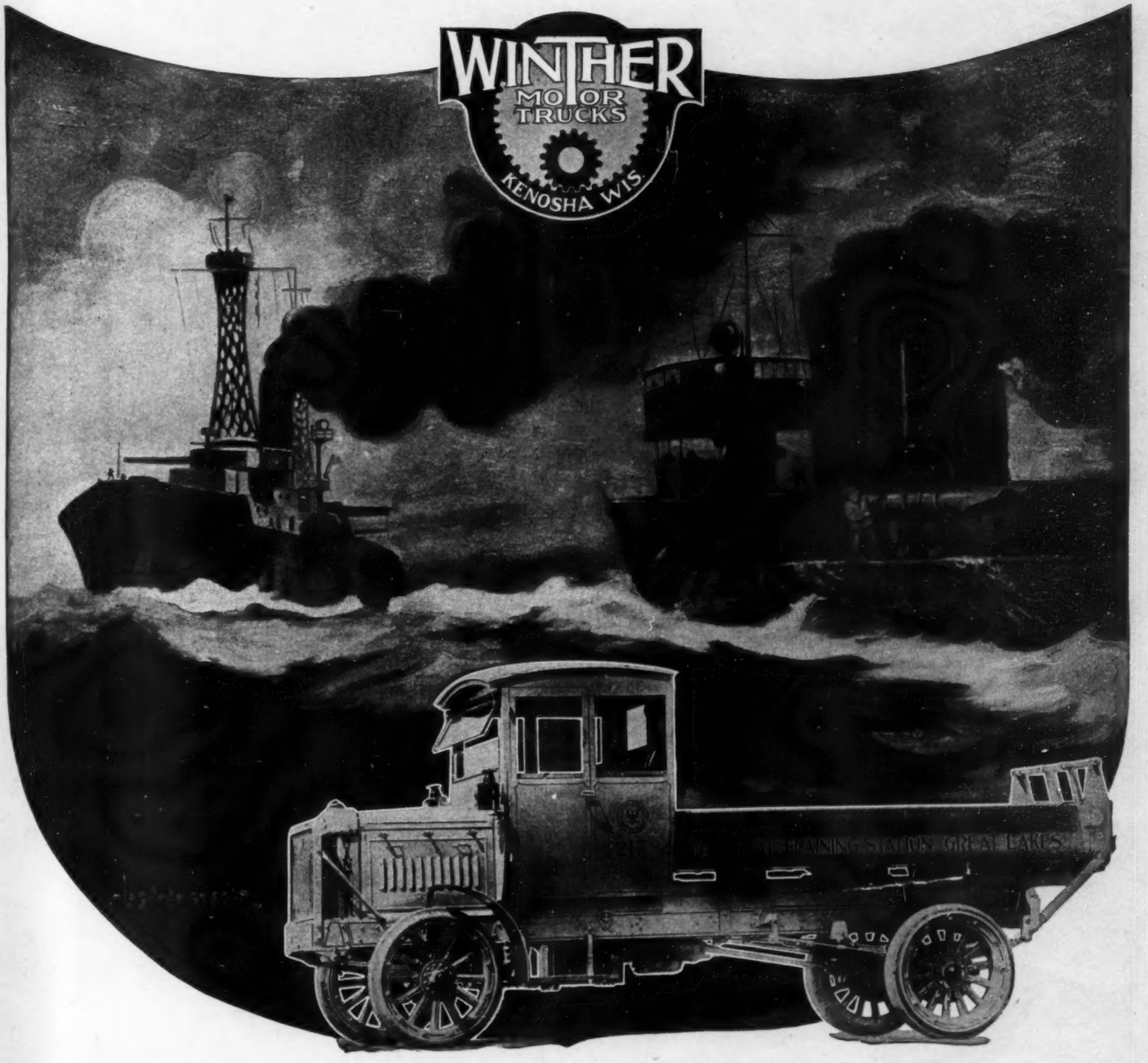
If the chemistry of explosives is complicated and far reaching, what shall we say of the processes of preparation of the thousands of dyes and other chemicals of the synthetic organic industry. No chart on any such model as we have used could possibly be prepared to cover this field; the attempt would only lead to confusion worse confounded. Even with the most complete knowledge, the close interdependence between all parts of the field often prevents effective production. Thus, the methods of preparing most of the German dyes are very well known to our chemists; but more often than not they cannot secure all the proper intermediates; and the lack of one such substance will frequently prevent the manufacture of 20 others. And when a new product is to be made in face of the fact that all the sulfuric and nitric plants have sold their entire outputs many months in advance to the munitions works, the problem becomes impossible of complete solution.

Let us remember, in trying to appreciate the difficulties, that 90 per cent of the enormous production of German dyes is monopolized by five companies, which for half a century have been continually improving their methods, which produce themselves all the chemicals they need, and which are financially powerful enough to crush out, by ruinous underselling, any attempt at independent production of important intermediates. Even in Germany it would be wholly impossible to establish a new dye factory. Consequently when German trade with the world was cut off, and with it the German supplies of dyes and coal-tar products generally, American chemists had no existing organization to build upon—they had rather to go back to the very beginnings and duplicate on a smaller scale the whole tremendous German system before they could show adequate results. Under the circumstances, they have done very well indeed.

Even in industries where the raw materials are simply modified without any synthesis, chemical interdependence reaches a point unsuspected by the layman. For example, take the rubber industry. To make rubber resist changes of temperature, it is vulcanized with sulfur and antimony compounds; to reduce costs, dilution is resorted to with substances made from various oils; to make possible a thin coating of rubber, it is dissolved in a quantity of different substances; for the numerous uses it is necessary to add pigments, fabrics, etc. We reproduce a most illuminating graphical representation of the ramifications of the chemistry of rubber, gotten up by Brunck and by him christened the "rubber tree."

And so it goes in all branches of chemistry. When, instead of mixing a number of raw products to get a desired substance, together with numerous by-products of the mixture, it is a matter of extracting several intermediates or finished products from one natural source, the interdependence of these products is absolute. It is only recently, after years of patient research, that a practicable method has been devised for extracting from crude petroleum more gasoline than it could give formerly. Perhaps the time will come when it will be possible to produce at will, from the raw petroleum, an abnormally high percentage of paraffin or benzol, according to market conditions. But at present we are very far from that. To get a given amount of gasoline we must break down a given amount of the raw oil; and in doing this we must, whether we like it or not, produce a given amount of every other petroleum derivative.

All modern industries are more or less interdependent. But the chemical industries are on the ultimate pinnacle of interdependence.




# *A Service of Which We Are Proud*

*Winther Standard rear drive motor trucks are built in seven sizes, 1½ to 7 tons.*

*Winther-Marwin four wheel drive motor trucks are also built in corresponding sizes, 1½ to 7 ton capacity. "Winther-Marwin" means four wheel drive.*

*The 1½ ton trucks in both rear and four wheel drive are especially designed for farm use.*

WITH the coming of Peace, we are permitted to speak of the special service we have been able to render the U. S. Naval establishment during the War.

Wherever the Navy uses trucks, in Training Stations, Navy Yards, in construction and land transport, there you will find Winther trucks,—many standard Chassis,—many of special Winther design, developed for strenuous and unusual uses.

Buying for permanence, it is not peculiar that the Navy has so largely used Winther. And the same qualities of durability, strength, power and economy which have there made Winther supreme, are making it also America's foremost high grade, heavy duty motor truck, in commercial use. With every American industry you will find Winther foremost in service.

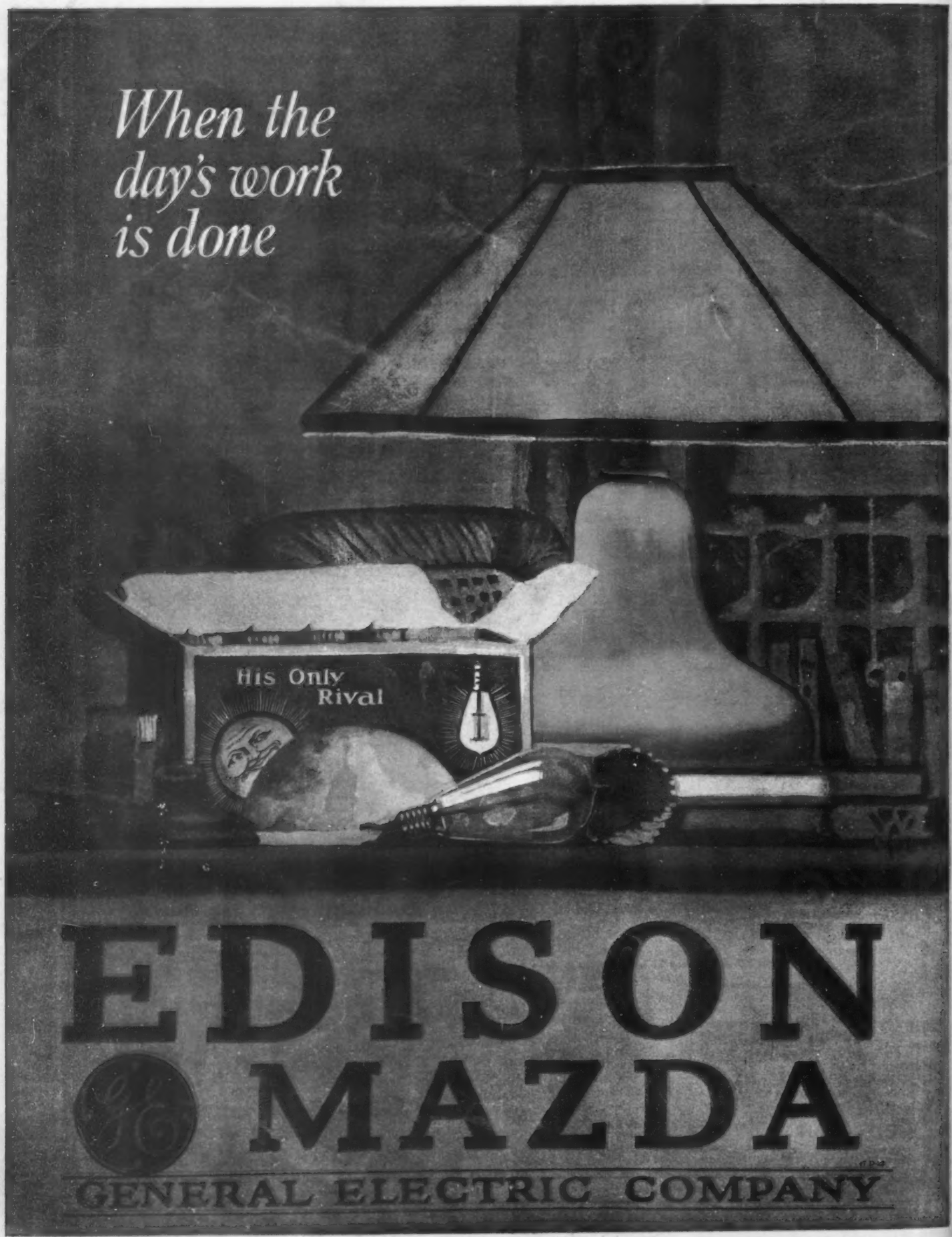
***Important Note**—In view of the present unsettled conditions in the material markets, it is important to bear in mind that present Winther prices are guaranteed without change at least until July 1st.*

*We shall be glad to send you full descriptive matter of all standard Winther rear drives and Winther-Marwin four wheel drive trucks and we invite correspondence concerning special chassis to meet special needs.*

**Winther Motor Truck Co.**

**Department H**

**Kenosha, Wisconsin**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is done
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